MONOGRAPH.

ART. XI.—*On the Causes and Treatment of Pseudarthrosis, and especially of that Form of it sometimes called Supernumerary Joint.* By EDWARD HARTSHORNE, A.M., M.D.

PSEUDARTHROSIS* (from ψευδης false, and αρθρον a joint,) may be defined to be a spurious, misplaced articulation instituted between bones or parts of bone; supervening, in the latter case, upon a fracture, and in the former on a dislocation. The first and more important species is presented in the seat of fracture of a broken bone, in which, at the proper epoch, there is still no consolidation. This is the *calli defectus* of the earlier writers; it consists either in the entire absence of callus, or in its improper distribution and defect of continuity from fragment to fragment. Such a condition presenting a point of motion in any part of a naturally unyielding bone, must obviously impair, if not destroy its function, and thus render the limb to which it may belong, proportionately useless. Béclard appropriately named this the supernumerary joint. (*Gén. Anat.* Trans. by Togno, p. 401.) The second form is the sequel of a neglected luxation. The joint is then created between the unreduced head of the dislocated bone, and the non-articulating surface of the bone and adjoining soft parts, with which its violent displacement has brought it into contact.

Of this kind also are the joints artificially produced by the celebrated operation of Dr. J. R. Barton, for the relief of anchylosis; and by White's operation for the resection of the diseased heads of bones.

The evidently vicarious nature of the second form of pseudarthrosis, as the only substitute for the previous natural articulation, has suggested the name, given also by Béclard, of supplementary joint. It possesses minor interest in most of its relations, and shall not occupy further attention in this paper. As a disease, it requires no treatment but such as will facilitate the completion of what is but a salutary change, intended to repair the loss of a congenital organ.

John Hunter,† Boyer,‡ and some others, made a verbal distinction of the pseudarthrosis succeeding fracture, into two varieties according to the anatomical characters. The simpler structure in which the ends of the bones were connected by a condensed cellular, or a fibro-cellular medium, was termed by them, ununited fracture, disunited fracture, unconsolidated fracture, &c., while they designated as genuine false joint, only the "accidental diarthrodial articulation," in which the extremities of the fragments were unconnected by any intervening substance, and merely held together by a loose and imperfect adventitious capsule.

* SYNONYMES. *False, Preternatural, Accidental,* and *Artificial joint; Fausse Articulation, Articulation Anormale, Accidentelle, contre nature, Falsche Gelenke.*

† Lectures on the Principles of Surgery, edited by Palmer, vol. i, p. 504.

‡ Malad. Chirurg. tome iii, sect. 4, art. iv.

Others, again, employ the terms ununited fracture, &c., alone; and comprehend by them both the irregular amphiarthrosis or flexible union, to which Hunter limited the meaning of these words; and the abnormal diarthrosis or bursal structure, which is, in reality, something more than a mere want of union in a fracture.

At present, the needless distinction of Hunter and others, is disregarded; and pseudarthrosis, false joint, and other terms of that class, are usually applied, in preference to the less logically accurate phrases, ununited fracture, &c., indifferently to every form and variety of the structural derangement. We propose to adopt the derivative at the head of this article, as the generic title of the lesion of which it treats; and to consider the two species, after Béclard, according to the primary affection, as supernumerary joint and supplementary joint.

In supernumerary joint may be recognised a significant expression for an infirmity which always creates more or less discomfort, and is often extremely distressing. If it be seated in one of the extremities, where, indeed, we most commonly find it, the limb is crippled, if not disabled, its muscles shrink from inaction, it is often shortened and crooked from displacement of the fragments, and an exuberant growth of irregular callus may increase the deformity. In this manner the part may become a useless, misshapen and unwieldy mass; sometimes so burthensome and even painful, as to render amputation itself a welcome alternative.

The calamity, however, is not always so deplorable. The character and position of the articulation may be such as but slightly to involve the use of the limb. This is more apt to occur in the upper extremity, where the lesion may occasionally exist without causing serious inconvenience. Mr. Syme has seen want of union both in fracture of the humerus and that of the fore-arm, in which the bones having been broken transversely, and the muscles being equally balanced, the limb, although it was quite flexible at the injured part, yet in a state of repose it could execute every exertion it was called upon to perform. (*Clinical Reports*, by Professor Syme, *Edin. Med. and Surg. Journ.* July, 1835.) Velpeau quotes instances of this, also one of a femur reported by M. Yvan as unattended with the usual loss of power. (*Méd. Opératoire*, tome ii, p. 582, 1839.) M. Cloquet gives an account of an individual, the upper third of whose humerus had been long destroyed without the voluntary motion of the arm being prevented. A man died in the Pennsylvania Hospital a year or two ago, in whose fore-arm there had existed a supernumerary joint of the radius for 35 years, without interfering with the active pursuit of his vocation, which was, to ply the needle as a tailor.*

Happily, fractures in general unite with so much facility and certainty, that, notwithstanding their great frequency, the untoward result of their failure to heal is comparatively rare. Only 13 cases† have been admitted into the wards of the Pennsylvania Hospital since the year 1829, and only one case of confirmed supernumerary joint has been known to originate in the wards of that institution in the last 40 years, during which time about 4000 fractures have been treated there. Yet this termination of a

* The preparation is now in the possession of Dr. Norris, one of the surgeons of the Pennsylvania Hospital.

† Of that number 9 were cured, 2 died and 2 were discharged at their own request. I am indebted for this and much other statistical information, to the kindness of Dr. G. W. Norris.

fracture happens sufficiently often, under certain circumstances, to fill the unwary surgeon with embarrassment, and to demand all his resources, perhaps in vain, to avert the misfortune. Not to dwell upon the misery it may entail upon the patient, there is enough in it that is harassing to the mind of the surgeon himself, as a provokingly tedious and obstinate disease, to give the study of it strong claims upon his sedulous attention.

It does not, however, appear to have received, of late, in this country, the ample consideration which it certainly deserves. We have, it is true, a number of short papers, most of which, however, are mainly occupied with the account of individual modes of treatment. We have also many valuable reports of cases, but not more at the utmost than two or three essays, claiming to be comprehensive on the subject, have issued from the American press.* Nor do our available English sources seem to afford a great deal larger amount of collected information. Although there is much important matter scattered about in various journals and other scientific records of the day, very few monographs on supernumerary joint have been published by British authors. Yet they have made the kindred subject of osseous reparation the theme of many admirable papers.

Probably one of the fullest articles on this form of pseudarthrosis, is to be found in the *last London edition* of Mr. S. Cooper's Dict. of Surgery, an invaluable work, of which it is likely that few copies have yet crossed the ocean. The later and more copious continental writings on this subject are still less accessible to cisatlantic readers. The rich tracts of Troschel, Langenbeck, Oppenheim, A. Bérard, and Seerig,† besides the older treatises of Reissesen and Salzman, are scarcely known to us even by reputation. That of Oppenheim alone has reached our shores. We have, however, among recent French articles of some length, that of Sanson in the *Dict. de Méd. et de Chirurg. Prat.* and of Vidal (de Cassis), Velpeau, Chelius and other systematic authors, together, with a crowd of detached reports which may be gathered from the principal periodicals devoted to the science of medicine in France.

Nor have we in our own or foreign publications any tabular statements and comparisons sufficiently detailed and extensive to assist materially the investigation of the causes and treatment of this pathological condition. The summaries of Oppenheim are the most important that I have seen, but they exhibit chiefly, general results, without giving us any of the particulars. No one questions at the present day, the value of statistics of this kind when properly compiled, as among the surest means of approaching to correct and positive conclusions. It is a matter of regret, therefore, that so little use has been made in this way, of the mass of

* The principal American papers are those of Dr. Hewson (on Mechanism of Preternatural Joints, *North American Med. and Surg. Journ.* January, 1828); Wright *American Journ. Med. Sci.* for August, 1828); and Heard (on Ununited Fracture, *New York Med. and Surg. Journ.* for Oct. 1839.) The last is the only recent one; the object of it appears to be to establish the claims of a plan of treatment said to be *peculiar* to the New York Hospital.

† *De Pseudarthrosi à Fractura Proficiscente*, 1838, by Professor A. H. Seerig of the Albertine University of Ratisbonne. This thesis is the latest, and probably the best. It is not obtainable in this country; and we have to rely upon the bibliographical notice of it by Troschel, who expresses surprise at the great number of observations collected by the author. (*Med. Zeitung, Encyclographic des Sci. Méd.* tome xxxiii, 2d series, September, 1838.)

well attested facts which have been long accumulating; and which are yet destined to shed much light upon the still doubtful points relating to this and other affections of the bones.

A tabular analysis of 113 full and authentic cases has been prepared by Dr. Norris (of this city), who is still adding to it from every source at his command. It bids fair to be the first attempt towards supplying the existing want in this country, while it is a greater effort than seems to have been made by any one abroad. His tables, together with the remarks which it is hoped he will soon present to the public, can not fail to be in the highest degree instructive.*

Meanwhile, the novelty of pseudarthrosis as the subject of a memoir, and especially the intrinsic interest of the graver form of it, have encouraged me, without pretending to offer more than a slight contribution, to devote the remainder of these pages to a brief notice of a portion of the materials within my reach relating to supernumerary joint.

The prevalent belief is, that the humerus suffers in this way oftener than any other bone. This impression is founded on the personal experience of many surgeons, but is not confirmed by the researches, as far as they go, of Dr. Norris. The following is a summary taken from his large table:—Of 113 cases, 37 occurred in the femur; 24 in the leg; 35 in the humerus; 15 in the forearm, and 2 in the jaw.

This, as well as the other summaries of Dr. Norris, does not include the joints which ordinarily follow infra-capsular fractures. S. Cooper gives the fullest list of these. In his words, fractures of the patella, olecranon, condyles of the femur, coronoid process of the ulna, acromion, and the coronoid process of the jaw, are generally united by a ligamentous substance. (*Surg. Dict.* Lond. 1838, art. Fracture.) It is very probable that these fractures, more particularly transverse fractures of the patella and olecranon, are followed by a movable joint between the fragments in a large proportion of cases, but some exceptions have been proved against the rule. Boyer and Desault, and more recently, Earle, Amesbury, Dupuytren and others, do not acknowledge it, and adduce their own success with these fractures in support of their position.

The supernumerary joint is nearly inevitable in the fracture within the capsule of the cervix femoris. No authoritative writer has ever denied the possibility of bony union in this case, but high and numerous authorities positively maintain its extreme improbability. Others have as warmly and elaborately advocated the doctrine that, except in the event of very advanced age, debility or other accidental cause, consolidation ought to be obtained. The discussion of this much agitated question, appears to have resulted in a pretty general admission; that the disputed ossifications *have* taken place, and that under favourable circumstances of youth, robust health, slight displacements, &c., they may be hoped for: but that such consummations are few and far between. MM. Richelot and Chassaignac, in their French translation of Sir A. Cooper's Surgical Works, estimate the proportion of instances of union to those of non-union, as one to fifty. S. Cooper tells us that Sir Astley himself now has in his possession a preparation† which he admits to be a genuine specimen of bony union within

* We expect to be able to present this paper to our readers before long.—Ed.

† There is said to be another undoubted specimen in the possession of Mr. Adams, Dublin.

the capsule.*—(*Surg. Dict.* 1838, art. Fracture.) The joint in the patella, &c., is for an obvious reason, usually attended with moderate inconvenience, especially when care is taken, (with due regard to other indications,) by approximating the disunited surfaces as much as possible, to shorten the connecting medium. The bond of union has sometimes been elongated by a too early use of the limb. An instance of this is described by Dr. Kirkbride. (*Clin. Reports, in Amer. Journ. of Med. Sci., for February*, 1835, p. 32.) Lonsdale also, who has remarked this in the patella, directs the continuance of the splint for a longer period on that account. (On Fractures, p. 438, 1837.) Still even when the separation of the fragments is considerable, the muscles in time accommodate themselves in some degree to the change.

Causes.—In entering upon the investigation of the causes of the supernumerary joint, the reader need hardly be reminded that it arises from the protracted disunion of a broken bone; or, in general terms, that it is the effect of whatever interrupts the natural filling up of a breach of continuity in a portion of the osseous tissue. We have, then, to review the circumstances alleged to be opposed to the regular advance of separation in such tissue, if we desire to ascertain any of these causes.

A numerous assemblage of conditions is reputed to be adverse to the union of broken bone. These conditions are mechanical or constitutional in their nature; the latter kind may be general or local.

Under the first head are enumerated motion of the fragments; want of apposition of them; the interposition between the fractured surfaces of foreign bodies, loose pieces of bone, or a portion of the soft parts. We find under the second, advanced age; malignant fever; cachexia from debauchery, &c.; considerable organic disease, phthisis, scurvy, syphilis, cancer, &c.; pregnancy; altered mode of life; insufficient nutrition of the bone; disease of the bone; disorder of the contiguous soft parts;—in short, "diseases and dyscracies of every kind."

These are the principal derangements, and will give some idea of the wide range of general disorders which have been suggested by various authorities, and repeated in the books and schools, as the probable conditions predisposing to supernumerary joint. But the reality of many of them as such, and the relative importance of the few less questionable among them, are by no means conclusively determined.

It is impossible to reconcile without supposing their uncertainty, the discrepant opinions of pathologists respecting them. Some will scarcely admit the existence of the second class; while others are almost as loath to yield any place to the first. We are told by one surgeon that he has repeatedly seen fractures heal without delay under circumstances which are announced by another as decidedly unfavourable to such a termination.

These conflicting statements, even without any more positive testimony, would warrant a strong suspicion that few, if any, of the so called influences can be constant in their deleterious action. Experience has proved the bad consequences of most of them to be as rare as they are variable. "There is no tissue," says a late writer, "in which union takes place more surely than in the osseous tissue, as the whole history of simple

* We have seen a specimen of this in the possession of Prof. Mussey, who informed us that he had met with two or three instances of bony union within the capsule of the neck of the thigh bone. We trust he will not further delay his long promised account of these cases.—Ed.

fractures clearly shows." (Dr. R. Coates *Am. Journ. Med. Sci.* for Nov. 1834, p. 160.) Few surgeons are there who have not witnessed admirable demonstrations of this truth. Lonsdale is disposed to suspect that the few cases in which union is not completed are the exceptions, not the general rule. In his opinion a very large statistical table illustrating the comparative frequency of union and non-union during the complication of any constitutional disease, is needed to enable us to judge with any confidence of the amount of weight to be attributed to it. (*Op. citat.* p. 84.) Sanson avers, what is probable enough, that none of the causes exert the same energy on different subjects. According to him, their action is null in the majority of cases, and we see fractures uniting quite as well in individuals infirm with age, or affected with syphilis, or scurvy, or in pregnant women, as in young and healthy persons. In a word, we see consolidation going on in despite of the greatest displacement of the fragments and in the most restless and intractable patients. (*Op. citat.* p. 494.)

Although the operation of the mechanical causes does not appear to be at all times absolutely incompatible with union, yet inordinate motion and malposition of the fragments have ever been accounted fruitful sources of obstruction to the cure of fracture.

To keep the parts at rest, after the reduction and coaptation of the separated surfaces is always the main object which the practitioner has in view in the management of this like that of every other simple wound. Surgeons of every age have exercised their ingenuity with unbounded zeal in the contrivance of a host of instruments intended to answer this important indication. The injurious disturbance of the fragments which these various kinds of apparatus have been devised to guard against may arise of course from many causes, which, however, it is not our province here to specify. Either the surgeon or the patient, or both together may be at fault; or they may be assailed by untoward complications and other difficulties, which no surgeon or patient, however competent on the one hand and docile on the other, could surmount or avoid.

Frequent motion of the fractured limb is the only cause of imperfect separation mentioned by Celsus. He speaks of fractures that have not consolidated *quia sæpe soluta, sæpe mota sunt.* Duverney, Desault, Boyer, J. Bell, C. Bell, A. Cooper, Dupuytren, Béclard, probably, nearly all the older writers, and most of those of the present age concur in regarding it as the most common cause. Duverney, the predecessor of Desault and Boyer, was particularly urgent and impressive in his admonitions in relation to the moving of a fractured bone. At the present day, in nearly the same sphere of action, Roux, Velpeau, Sanson, and others, are equally positive in giving motion the precedence, in the of category ills by which a fractured bone may suffer. According to Liston, it is only in case of previous disease of the bone that disunion cannot generally be attributed to some carelessness either of the surgeon, or of the patient. (*Elements of Surgery*, page 312.) Seerig, in Germany, affirms, that false joints would be much more rare if fractures were always dressed immediately after their occurrence. (*De Pseudarthrosi a Fractura Proficiscente*, 1838.—*Troschel, Encyclograph. Des. Sc. Méd.* tome 33, 2*me serie*, Sept. 1838.) "In this way only;" remarks Dr. Macfarlane after expressing an opinion similar to Liston's, "can we explain the fact that false joints after fractures are most frequently met with in the humerus, because we know it to hold good as a general rule that diseases and injuries of the

upper extremities are more manageable than those of the lower," (*Surg. Report of Glasgow Infirmary, Edin. Med. and Surg. Journ.*, vol. xlvii, 1837.) It might be added perhaps, that in this way can we most plausibly account for the fact, that not a few cures have been obtained of such joints, even several months after the fracture; as well as of retarded union of shorter duration, by the aid of retentive apparatus alone. Witness the reports of Boyer, S. Cooper, Troschel, Velpeau, Amesbury and others.

The fact that the supervention of pseudarthrosis upon fracture is a mishap nearly unknown in the wards of large hospitals, and in the practice, however, extensive, of careful surgeons,* affords still stronger presumptive evidence of the greater frequency of the mechanical impediments to bony union and above all of that of motion.

Out of 44 authentic cases analysed in Dr. Norris's table, 22 were evidently produced by bad treatment. Others might be stated here in addition to his, were it necessary to occupy so much space and time in discussing what seems to be a scarcely mooted point.

Brodie, however, although he does not wish to deny that the motion of the limb can be sufficient to prevent union, is yet somewhat disposed to doubt it, and thinks that in most instances the fault is to be found in the state of the constitution. He has found after trying the experiment upon them again and again, that it was followed by no such consequences in the bones of inferior animals. (*Clin. Lect. on Ununited Fractures, Lond. Med. Gaz.*, vol. xiii, p. 56, 1834.) This does not coincide with the experience of MM. Breschet and Villermé. These gentlemen describe nine supernumerary joints produced inthe bones of dogs; the rudiments of six of them were recognized at the expiration of the 18th day.

"The somewhat injudicious application of dressings, cannot, in my opinion," says Oppenheim, "be considered as a real source of non-union: otherwise, cases of false joint would be much more common than they are."—(*Zeitschrift für die gessammte Medicin*, May, 1837.) In support of this, he adduces the fact, that compound fractures, the treatment of which requires the daily disturbance of the fragments, nevertheless, fail to consolidate no oftener than simple fractures. This argument controverts the dogma of the necessity of *perfect* rest contended for by some surgeons of mechanical celebrity, more forcibly than it does the validity of unrestrained motion as a promoter of pseudarthrosis. For the comparatively slight movement of the limb, unavoidable in dressing the wound, is of the gentlest nature; is made usually at stated periods and intervals of some length; and generally may be dispensed with at the critical period of commencing consolidation, since at that time, the external wound may no longer need so much attention. Oppenheim uses a second argument which is more to the purpose. He states it thus:—Neither can the influence of this cause be well assumed in fractures of the leg or fore-arm when one

* Liston never met with but one in his own practice, and that was brought on by the "absurd conduct of the patient" in using his broken arm, and removing the splints without consulting his surgeon. (*Elements of Surgery*, p. 331, part iii.) Troschel justly remarks, of the different modes of treatment of simple fracture, that in the practice of many surgeons whatever be their theory, it is very rare to observe pseudarthroses in important places. (*Encyclograph. des. Sc. Méd.* tome xxxiii, Sept. 1838, from *Med. Zeitung.*)

bone unites and the other remains disunited. These arguments, drawn from experience, against the incompatibility of motion with the regular consolidation of fractures, have doubtless presented themselves to other practitioners; and well deserve attentive consideration. They were promulgated in this city by Dr. Hewson, nine years before the publication of the paper of Oppenheim, from which we have just taken them. (See *N. Amer. Med. and Surg. Journ.*, Jan., 1828.) It is true, that several cases, such as those brought forward above, in which one of two broken bones in the same limb unites, and the other does not, are known to have occurred in America as well as abroad.* It is well known, moreover, that cases occur in persons having every appearance of high health, and who have been treated with unimpeachable skill and judgment. As many as 22 at least of the 113 cases in the analysis of Dr. Norris received the best treatment and presented no symptom whatever of ill health. Ruysch and Van Swieten long ago observed cases of this kind. White (*Cases in Surgery*, p. 85, 1760.), Boyer, (*Op. citat.* vol. iii, p. 82,) and others quote them. S. Cooper speaks of "certain indescribable constitutions, in which bones will not unite again after being broken," and gives two examples. (*Op. citat.*) Sanson avers, that there must be "a peculiar and hidden disposition, or, if you will, a sort of predisposition, which is sometimes so powerful, that it alone suffices to retard considerably the reunion of the fragments, or entirely to prevent them from consolidating." He cites five cases in which it was impossible to discover any appreciable cause; and is inclined to believe that no surgeon of much experience has not seen something of this description.—(*Op. citat.* p. 494.) The pretty well established existence of this unknown cause of itself alone gives ample room for the indulgence of speculation, while it casts a shade of doubt over the more substantial etiology which we would fain believe to be founded on matter of fact.†

Mr. Amesbury, although he does not neglect to give some weight to

* A remarkable instance of two distinct fractures in the same bone, one of which healed directly and the other became a joint, is related by Mr. Houston, (Obs. on Fractures, &c., *Dublin Journ. of Med. Sci.* for Jan. 1836.) An old woman, by a fall, fractured her thigh bone. After lying in the hospital for several months, without any apparent suffering, her limb was braced up with adhesive strips, and she was enabled to walk about by the aid of crutches. She did not, however, long survive her convalescence. After death, it was discovered, that in addition to a transverse fracture of the middle of the shaft, a perpendicular one four inches in length, ran up to the trochanter. The transverse lesion exhibited a perfect false joint with fibrous capsule and synovial membrane, whilst the portion detached by the perpendicular fracture had become firmly and universally united to the original bone, in a manner which showed that the union must have been accomplished in a very short period from the receipt of the injury. Mr. Houston gives the foregoing as a singular illustration of his point, in questioning the accuracy of the doctrine, that want of inflammatory action will be attended with a corresponding imperfection in the secretion of callus. In continuing his remarks, he goes on to say, "Here the common explanation will not hold good, as the action was fully competent to the reparation of the lateral fracture, though it failed in the transverse one." Want of proper apposition, and the frequent occurrence of motion between the two main pieces of the bone, he supposes, with good reason, to have been the cause of non-union at this part. It appears to be a forcible and rare illustration of the effect of these mechanical causes.

† The specious cognomens of "a peculiar disposition," "a concealed cachectic vice" &c. &c., afford but a very thin cloak to our real ignorance of the true nature of these pathological phenomena.

other causes, goes further than most authorities in denouncing the want of rest in fracture, as fatal to the work of reparation. He is disposed in nearly every instance to accuse the apparatus, rather than the constitution, as the root of the mischief. The opinions of one who has seen so much of this kind of disease, would be of much higher value, were it certain that they are not more or less biassed by his predilection for a peculiar theory, his devotion to which is not very well calculated to increase our confidence in his expositions. His statements, therefore, that out of 90 cases of supernumerary joint, only 4 could be attributed to constitutional derangement, we are forced to receive *cum grano salis.*—(See *Amesbury on Fractures*, vol. ii, p. 720, 1832.) We are by no means convinced that the whole 86 cases are to be charged to defective treatment in any but Mr. Amesbury's acceptation of the phrase. One of those cases was attended for the previous fracture by Sir A. Cooper, another by Mr. Green, either of whose names is enough to assure us that in those instances, at all events, no mismanagement existed. Nevertheless, his representations, proper allowance being made, are highly important, but they do not appear to sustain the somewhat ultra doctrine that *absolute* rest and apposition are indispensable to the ready cure of the great majority of fractures. This hypothesis is one which John Bell was at great pains to overthrow, (although then existing only in his own prolific imagination,) when lecturing against the "continued extension" of Desault and Boyer. It is abundantly disproved by the success which these distinguished French surgeons themselves so long enjoyed in the vast field of their triumphs, and is equally confuted by the every day experience in the public and private practice of the last half century on both sides of the Atlantic.

According to Lonsdale, not more than 5 or 6 cases of supernumerary joint (except those within a capsule,) have occurred out of nearly 4000 fractures that he saw treated during 10 years at the Middlesex Hospital. In that institution "none of the fractures are treated with the absolute rest which Mr. Amesbury describes as being only attainable by his various kinds of splints." (*Op. citat.* p. 89.) In the Pennsylvania Hospital, where the simplest dressings only are employed, and where Mr. Amesbury's machines never found approval—out of 948 fractures, during ten years, not a single case (excepting always those arising from an infracapsular fracture,) has originated in the wards. As far as can be ascertained, only one genuine pseudarthrosis has followed a fracture treated there in the course of the last 40 years. In that solitary instance, the joint was most probably owing to the mistaken indulgence of the attending surgeon (long since dead,) who yielded to the entreaties and vociferations of the patient, and forbade the application of the extending and retaining apparatus. Hammick, who has seen, according to his own account, as much of fractures as any man living, informs us, that he never discharged from the Plymouth Hospital more than 3 patients with the bones not united. (*Lects. on Fracts., Ampts.*, &c., p. 122, 1830.)

We take leave of the study of the effects of motion on a fracture in stating them as detailed by Mr. Palmer. In his words, "The ossific process is arrested, and a new disposition created for the formation of a bursal structure, similar to what takes place in other parts of the body when friction is employed. It should be observed that constant motion of a fractured bone will inevitably lead to false joint; but this will be differently

formed in different cases. If the process of union has been interrupted from the commencement, the broken surfaces will be rounded off and covered with hard enamelled surfaces, enclosed by an adventitious synovial bursa; but if the interruption has taken place during the ossification of the callus, then the extremities of the bone will be united by a cellular or fibro-ligamentous structure." (HUNTER'S *Lectures on the Principles of Surgery*, edited by Palmer, vol. i, p. 504.)

Want of apposition of the fragments, is thought by some persons to be a more serious evil than want of rest. The records of surgery contain many proofs that it is by no means constant in its bad effects. In White's first case of resection, (not for pseudarthrosis, but for caries,) in which the head of the humerus was removed, there was a loss of four inches of the whole substance of the bone, yet the limb was shortened but one inch. From the unaltered figure of the arm, its entire usefulness, and its appearance to the eye and touch, the operator, in the plenitude of his satisfaction, though he might "safely say the head, neck and part of the body of the os humeri were actually regenerated."

Gooch narrates a case in which the loss of 5 inches of the tibia was supplied by solid bone; Van Swieten, one of the restoration of 4 inches of the bone, and La Motte another in which 6 inches were replaced; (see White and others.) Heister quotes an instance, about which he himself is a little skeptical, given by Horstius, of the regeneration of "3 fingers breadths of the bone of the foot." Mr. B. Phillips saw the renewal of 5 inches of bone in one case, and of a large portion of the clavicle in another. (*Lectures on Surgery in Lond. Med. Gaz.* for 22d of May, 1840.) Examples of this kind must be familiar to every hospital surgeon. So also must be those where, particularly in compound fractures, union has followed, notwithstanding much displacement and very slight contact of the fragments, even by their sides.

The great difficulty of approximating the fragments in transverse fractures of the patellæ, olecranon, &c., is given by many surgeons as one of the principal causes of their non-union, except by flexible membrane.

Foreign bodies, or pieces of dead bone, either by mechanical interposition, or by irritating the parts into suppuration, may sometimes interfere with the sanatory process in a fracture. The effects of pieces of cloth, bullets, splinters, &c., in keeping up a profuse and long continued flow of pus are well known. Benjamin Bell tells us that he has "met with different cases [of simple fracture] where a cure being considered as impracticable, from no union having formed between the ends of the fractured bones, it was at last accomplished in the course of a very short time by the removal of some of the loose fragments." (*System of Surgery*, Edinburgh, 1788, vol. vi, p. 44.) He also remarks that a considerable accumulation of blood around the seat of fractures is very apt to interfere with the progress of union. More recently Mayo and Lonsdale have observed this effect of copious extravasation of blood, in the Middlesex Hospital. (Lonsdale, *Op. citat.* p. 90.) Foreign bodies may remain in a fracture without giving rise to any bad symptoms, and may be enclosed in the new formed callus. A remarkable instance of this is related in the *Gaz. Méd.* for July, 1838. A piece of iron 35 lines in length and 5 in breadth was found by M. Vogelvanger, after death, and two years after the accident, completely embedded in a deposit of callus in a fractured femur.

A portion of muscular or fibrous tissue interposed between the fragments, has been considered an occasional obstacle to reunion. It was first suspected by White (of Manchester); B. Bell dwelt upon it as a most perplexing accident. Wardrop described it, and suggested an operation for the removal of the intruded membrane. S. Cooper, Sanson, Brodie, and many others, have noticed it in succession. Liston ridiculed the idea of such a difficulty as an "absurd notion." (*Clin. Lect. on Fractures, Lancet*, vol. ii, 1836.) According to Macfarlane, the forcing of lacerated portions of muscle or tendon between the ends of the fractured bone is not at all uncommon; but these, particularly the former, become absorbed by the firm pressure employed to retain the bones in place. "It is different," continues he, "when the bones are not accurately approximated, or when the intervening substance does not yield to the pressure to which it is subjected." (*Loc. citat.*) In many instances of this kind there is so much displacement, that the bones appear to be thrust as much into the muscle as the muscle to be driven between the bones. The case in which Mr. Rowlands operated by resection, may serve as an example of the condition last described by Macfarlane in the above quotation. It was that of a fractured femur, the broken ends of which were so separated by a fleshy substance between them, that it was impossible to bring them together. (*Medico-Chirurg. Trans.* vol. ii, p. 49.) This state of things is familiar to surgeons, as having been not unfrequently met with in operations for the relief of supernumerary joint, and no other instances need be recounted here.

Compression from a too tight bandage, or compression too long continued, is a predisposing cause which has a rather ancient reputation. It is mentioned by Ambrose Paré, (*Workes of that Famous Chirurgion*, Trans. by Thomas Johnston, Lond. 1649, lib. xv, p. 379,) and is the object of a caution which is said to have been handed down from the founder of surgery himself. Tropa long since satisfied himself that it prevented the formation of provisional callus. Within the last three years it has been urged by M. Fleury as a far more frequent cause than was generally imagined, in consequence of the prevailing system of treating fractures by the immovable apparatus. He cites four cases as examples of its influence. (*Archives Générales*, vol. xliv, p. 442, 1837.) According to Sanson, Velpeau and others, it acts by producing a sort of atrophy of the limb, which presents the aspect of what Jules Cloquet has described as *scorbut local.* Brodie thought the want of consolidation due, in the event of too great pressure, to its cutting off the supply of blood from the seat of fracture. Malgaigne attributes the want of union under the same circumstances to the pressure hindering the deposit of the provisional callus. (See Velpeau, *Méd. Opérat.* tome ii, p. 584.)

Constitutional Causes.—It has been already intimated, that there is a great lack of unanimity among writers, respecting the influence which is somewhat vaguely and hypothetically assigned to many of these conditions of the general system.

Supernumerary joints have undoubtedly occurred under circumstances, which analogy would lead us to infer to be exciting causes. But it is equally undeniable that fractures have been repeatedly consolidated under similar circumstances without the slightest difficulty. It cannot be denied then, that our knowledge of the mode of action of these causes, based upon extended observation, is limited to an unsatisfactory degree.

An opinion to this effect is thus stated by Vidal (*de Cassis*) in his *Pathologie externe*, (vol. ii, p. 18, 1839.) "Renewed and accurate observations are required to confirm these data supplied by theory; or, at least, it behooves us to establish more precisely, in what case, and how far, these states of the system contravene the production of callus." Again, "Be it as it may, when we closely scrutinise these questions, and seek in the annals of science the facts on which the authors of these propositions have based them, we are astonished at their rarity, and the little value of the greater part of them. Amesbury, however, firmly persuaded as he is that in the large proportion of joints after fracture, their origin is due to the defects of the ordinary mechanical treatments; nevertheless does not hesitate to say "that the process of union in bone, is influenced by all those causes which affect the healing of the soft parts.* Were we disposed to be satisfied with mere conjectures, the analogy thus hinted at would tend strongly to impress us with the importance of attending to the constitutional causes. Experienced practitioners are not wanting who lay great stress upon the influence of the general health.

The ideas of Brodie and Oppenheim have already been submitted. Hammick suspects that there are many more causes besides motion for a failure of union than are commonly imagined. No one had a better opportunity for forming an opinion from his own experience than this able surgeon long enjoyed in the Plymouth Naval Hospital.

Let us consider separately some of the principal of these derangements of the organism.

1. *Old Age.*—It is easy to conjecture how the altered structure of the tissue and the enfeebled actions of the economy incident to what is styled old age, may preclude the growth of callus. But although the tediousness of the recovery of aged persons, after a fracture is a matter of continual remark; yet, in the absence of sufficient data, we are at a loss to know how much even here to attribute to the physiological dyscrasy alone. Fractures have been known to heal steadily and surely in individuals of both sexes far advanced in years. Some idea of the relation of age to the frequency of supernumerary joint may be formed from another of Dr. Norris's summaries.

Between the ages of	10	and	20	there were		14
Between	"	"	20 and 30	"	"	38
Between	"	"	30 and 40	"	"	16
Above	"	"	40	"	"	18
						86
Of the cases in which no age was stated						27
Total						113

We may also, by a similar course of reasoning, without difficulty, account for the failure of union in a cachectic patient, in one suffering

* "Causes of non-union might be said to be either constitutional, constitutional and local, or purely local. * * The constitutional are fevers, scurvy, &c.; also some organic diseases, as phthisis, dysentery, &c,, which occasion great disturbance in the system; likewise constitutional debility, as scrofula, &c., or acquired, as that enfeebled state which is often produced by habitual debauchery." (Amesbury. *Op. citat.*, vol. ii, p. 713.)

from a debilitating acute or chronic disease—such as dysentery, for example; or, in the last stage of phthisis, cancer, syphilis, &c. One could readily theorise in support of such a belief, but we want many facts to sustain it, and have already in our possession some that are, at least, exceptions to the given rule.

Inordinate vascular depletion, long continued fasting, a depraved diet, the withdrawal of an habitual stimulus—All have been seen to impair very decidedly the reparative function. Their injurious operation was much regarded by the older surgeons. Paré in speaking of "those things which retard the generation of a callus," gives a prominent place to the use of "such nourishment as offends in quality, or quantity, or both." (*Op. citat.* p. 379.) J. L. Petit, Heister, Duverney, &c., recommend a more nutritious diet, after inflammation is no longer to be dreaded. They were particular to allow the patient "nutriment solid and proper for his constitution and manner of living." (Duverney, *op. citat.* p. 170.) The propriety of their precautions has been well exemplified by Brodie, and more lately by a writer in the Medico-chirurgical Review, (vol. xxiv, New Series, Jan. 1836,) each of whom cites striking illustrations of the effect of an altered mode of living. A gentleman accustomed to the enjoyments of the table, in order to check and reduce his increasing corpulency subjected himself to a very spare diet. After six months' "starvation" he broke his arm and was seen by Brodie months afterwards with the bone still ununited. A lady by pursuing a similar system of abstinence hoped to effect the same object, and having broken her arm was equally unfortunate. (Brodie, *Op. citat.* p. 57.) The same author further quotes a case, which Wilson used to relate of a dram drinking woman who broke her leg. The bones exhibited no disposition to unite until she was allowed to take her customary drink, when they healed immediately.

Cold Applications.—The continued application of cold dressings to the limb after their indication has ceased was accounted by Dupuytren as not only instrumental in retarding consolidation but even in exciting reabsorption: hence he proscribed all baths and douches during convalescence. His admonitions on this point are repeated by Amesbury and others. Vidal de Cassis asks for more facts to confirm the accuracy of Dupuytren's opinion. It is an old remark also that fractures heal more slowly when exposed to the cold of winter. Boyer supposed temperature to have some influence but believed it to be very slight. During the rigorous winter of 1830, M. Goyraud collected some facts which accorded with the popular belief. Vidal de Cassis, (*op. citat.* p. 18.)

Paralysis.—Want of innervation from paralysis may render all attempts at effecting consolidation abortive. Mr. B. Phillips relates a well marked case, in which the same accident that fractured a man's thigh injured the lower part of his spine. He lived five weeks, but there was no effort at reparation. (*Op. citat.* p. 327.)

Scurvy.—The baneful effects of scurvy upon fractures, as upon all other wounds, have been demonstrated beyond all doubt. Many of the writers of the middle ages were familiar with its disastrous influence. (See S. Cooper, *Op. citat.*) "Scurvy," says Hammick, "will not only prevent union but dissolve it after it has been formed for many years. In the famous siege of Gibraltar where this disease made great ravages, bones became separated which had been for a length of time united." (*Op. citat.*

p. 118.) Callisen also states that the callus of an old fracture could be thus softened by a scorbutic taint. *A labe scorbutica callum fracturæ diu sanatæ iterum mollescere posse ipsi observabimur.* (*Systema, Chirurg.* tom. i, pars xvii, ord. iv, p. 733, 1798.) The reader will remember the oft quoted history of Lord Anson's Voyage which describes old fractures as giving way, and the scars of old wounds or ulcers as breaking out anew in many of the sailors who were prostrated by this horrible disease.

"In the early part of the French war," we quote Hammick once more, (p. 118,) "about the years 1793–4–5, we received a great number of the worst cases of scurvy—at least six hundred; and although I never recollect an instance of its having dissolved the union of a fractured bone which had attained to any degree of firmness, yet it entirely prevented it from taking place whilst the patient was labouring under any scorbutic diathesis. Bad diet, and foul air from confinement in ill-ventilated dark rooms, or underground cellars, will prevent union." This author had an opportunity of observing the latter at a time when the hospital was extremely crowded.

Cancer has long had the reputation of being unfavourable to the firm reunion of bone. S. Cooper attended cases in which the cancerous diathesis appeared to be the deleterious agent. He quotes Leveillé (*Nouvelle Doct. Chirurg.* tome ii, p. 159) as having watched them in l'Hotel Dieu, also Sir Astley Cooper, as having met with instances in his practice. There are examples on record, however, of success in the treatment of fracture even in advanced stages of cancer. Mr. Brodie treated an old woman who was "dying with cancer," and who, in turning one day in bed, broke her femur. Contrary to his expectation, the fragments united perfectly well. Mr. B. had the care of a lady who had cancer of the breast, and pains in the limbs, indicating cancerous diathesis of the bones. The clavicle which was affected with scirrhus, was accidentally broken by the motion of her arm, but it united as readily as a healthy bone.

Liston gives a well marked case of unexpected success of this kind. A female ætat. 49, fractured her humerus by slight muscular exertion. She had long laboured under some affection of the spine which confined her to bed. She presented also a well developed carcinomatous tumour of one mamma, the axillary glands being involved. The other mamma was in progress towards the same condition, and a schirrous tumour had made its appearance behind the angle of the jaw. Her surgical attendants were fearful that the fracture had arisen from the malignant degeneration of the medullary canal of the bone, which occasionally takes place in a system thoroughly pervaded with the carcinomatous diathesis. They were agreeably surprised, however, to find the healing of the fracture going on just as well as under ordinary circumstances. (Liston, *Clin. Lect. on Fracts.* Lancet, April 30th, 1836, p. 165.)

Syphilis.—Oppenheim totally discards the suspicion that syphilis retards the union of fractures. He cites various cases from his own experience, in which the constitutional disorder made not the slightest impression on the fracture, and quotes Lagneau (*Exposé des Sympt. de la Malad. Ven.* Paris, 1818,) and Berard (*Des Causes qui empechent ou retard la Consol. des Fracts. &c.*, Paris, 1823,) to the same purpose. He is strongly inclined to ascribe the failure to the remedy employed rather than to the disease. (*Op. citat.*) Sanson has had the care of two

decided cases, which soon gave way to appropriate treatment; (*Op. citat.* p. 492.) Hammick speaks of some fractures which he cured by the aid of mercury; and thinks that this may often be indicated where union advances slowly, and a venereal diathesis is to be suspected. (*Op. citat.* p. 117.) Vidal de Cassis believes that syphilis can rarely derange the formation of callus.

Pregnancy and Lactation.—The same, according to this author, may be said of *pregnancy*, which, together with *lactation*, is regarded by many pathologists as sufficient to check reparation. Leveillé, Boyer, Delpech, Dupuytren, S. Cooper, Liston and many others, have met with fractures that were not prevented from consolidating in the usual time by the co-existence of the gravid uterus. Dupuytren has seen a fracture heal readily in a pregnant woman, who, at the same time, was afflicted with cancer. On the other hand, Hildanus relates two cases of supernumerary joint produced in pregnant women. (*Obs. Chirurg. Cent.* v, obs. 87.) Alanson (*Med. Obs. and Inq.* v. iv, No. 37,) reports one, Hammick three, and Amesbury two. Wilson mentions two that he met with, but speaks of others, in which this state of things made no difficulty further than perhaps a short delay. (*On the Human Skeleton*, p. 214.) Hammick would not be understood to attribute any direct action to the state of pregnancy, but surmises that it may be due to the debility which gestation sometimes produces. This appears to be the idea of Amesbury in relation to his two cases. Liston, after observing that he had often seen pregnancy to have not the slightest effect, goes on to say, "Profuse uterine or vaginal discharges, or determination to particular parts or organs, will certainly retard union." (*Elements of Surgery*, p. 460.)

Local disorder.—"According to Langenbeck," says Sanson, "a fever, an erysipelas, causes which must be regarded as the least active, have sufficed to soften callus already far advanced." The experience of others accords with this: Wardrop met with two cases of this kind, which he details in his paper in the *Medico-Chirurgical Transactions*, (vol. v;) Malgaigne, (*Lancette Française*, tome iii, p. 218,) and Vidal de Cassis, each reports a case. Dr. Kirkbride published the notes of two that came under his eye at the Pennsylvania Hospital. In the first of Dr. K.'s cases, the patient returned with an ulcer over the part, to the hospital, whence he had been discharged cured of the fracture one month before. About three weeks after his return the ulcer commenced sloughing without any assignable cause, and before this could be subdued, the recent callus was absorbed. Caustic was applied to the bone; within three months and a few days, the ulcer was cicatrized, and the bone firm. (*Amer. Journ. of Med. Sci.* for Feb. 1835.

Free suppuration has repeatedly proved a serious obstacle to the regenerating process. The detrimental influence of a constant flow of pus around the seat of fracture is dwelt upon by Pott, J. Bell, S. Cooper and others as very great. Their views are verified by the experience of every hospital surgeon.

Disease of the bone.—If disease of the parts in the vicinity of the fracture may sometimes exert so unhappy an effect, disease of the bone itself must be a still greater misfortune. This is generally the fact, as the annals of surgery fully show. Heister appears to be the first among modern authors who attached much importance to it. He quotes a case from J. L. Petit, and gives the particulars of one that presented itself

in his own practice. A student of medicine, about 20 years of age, was for several years troubled with an ulcer and caries of the inner and middle part of the femur, near the course of the femoral artery. Unluckily, he broke his thigh at the point of caries. Heister was unwilling to dilate the sinus and cauterize the ends of the bone for fear of injuring the artery. The fracture never healed, and the young man dragged a miserable life. (*Gen. Syst. of Surg.* 7th ed. of Eng. Trans. 1763, p. 128.) This and Petit's also, which was cured, was a case of previous disease of long standing. But examples could be multiplied of recent diseases of the bone which have produced supernumerary joint, and have resisted all treatment but that of removal of the affected surfaces. The most remarkable case of disease of the bone was that reported by Marx and Paillard, where a mass of hydatids appeared in the seat of fracture and effectually prevented the reunion of the bones until it was discovered and removed by Dupuytren, in whose wards the case occurred. (*Journal Hebdomad*, 1833, t. xii, p. 97.(

Even in the event of disease of the bones, however, the rule, to use the expression of Brodie, is not absolute. This surgeon had a patient who suffered from the disease of bones, on some of which there were nodes. The clavicle which was the most enlarged and much diseased besides, was broken in the diseased part. To his surprise, it united without the slightest difficulty. Mr. Houston gives an instance, stated to him by Professor Kirby, of "a middle aged man in whom almost every long bone of his body had been broken at one time or another from trifling causes, but notwithstanding what might be called in this case great weakness of the system, all these accidents were repaired with very little suffering, and in a moderately short space of time. (*Dublin Journ.* Jan. 1836, p. 494.) Such examples are not extremely rare. Some very interesting ones are detailed by Professor Gibson. (*Outlines of the Instit. and Pract. of Surgery.*)

Unequal nutrition of the fragments depending on the distribution of the nutritious artery is a local condition of a physiological nature lessening the chances of reunion which has of late years met with much attention from pathologists. The limited supply of blood which the head of the femur necessarily receives when detached from the shaft by fracture within the capsule is regarded by Sir A. Cooper, Boyer and others, as one of the chief difficulties in the way of consolidation of the neck of that bone. This feeble vascularity added to the want of rest and apposition of the fragments is, in their opinion, sufficient to ensure a supernumerary joint in nearly every case, independently of the "senile atrophy" that is often present in that part. Earle, Amesbury, Dupuytren, and their respective partisans deny this, and attempt to prove that the causes of the joint after such fractures are purely mechanical and may be counteracted. There is, however, in operation here, another physiological cause somewhat analogous, and alike negative in its character, which was first explained and insisted on by John Bell, and since his time, by Brodie, Syme, Mayo, Lonsdale and others. It is the absence of the bed of vascular soft parts—cellular tissue in other words, in which most of the supplementary callus is elaborated, as it were,—and which is now considered of material importance to the speedy cure of all fractures. To the want of this is at the present day attributed the slow growth and indeed the frequent absence of callus in fractures of the cranium, as well as the liability to false joint in all infra-capsular fractures.

The derangement of the circulation of a limb by the deligation of its main artery is reputed to be sufficient to interrupt consolidation. According to B. Phillips, this, like every other asseveration of the kind is supported by a few cases.

M. Vidal de Cassis, (*Op. citat.* vol. II, p. 64,) gives an account of some curious researches recently undertaken by M. A. Berard, and followed up by M. Gueretin. They show that the epiphysis of a growing bone, towards which the nutritious artery of that bone directs its course, is consolidated with its shaft sooner than the epiphysis which belongs to the opposite extremity of the same shaft. For instance, this fusion of the condyles of the humerus with the lower extremity of the corresponding shaft advances more rapidly than that of the head of the humerus with its upper extremity, because the nutritious vessel runs from above downwards. Vidal informs us, that M. Gueretin has further discovered a similar relation between the direction of the nutritious canal, and the position of supernumerary joints. The former gentleman has thought it worth while to construct and publish a table of M. Gueretin's results. We subjoin them here as possessing even now more than the interest of novelty, while an extended investigation may prove them to be of great importance in enabling us to solve the question of the obscurer causes of the malady which now occupies our attention.

In the humerus, the nutritious canal courses from the middle of the shaft *downwards*—out of 13 cases in this bone, 9 were found *above* the nutritious foramen and 4 below. In the fore-arm the artery runs from below the middle of the bones *upwards:* 7 cases out of 8 presented *below* the canals in these bones. The nutritious artery in the femur is directed *upwards* from the middle of the shaft: here 5 joints occurred *below* the canal and 3 above. In the leg, the canals have a direction *downwards:* 4 joints were seated *above* the canals in the leg, and 2 below them. These researches will remind the reader of the interesting paper of Mr. Blizzard Curling, on the atrophy of bone, wherein he published his discovery of the effect of the accidental obliteration of the nutritious artery after fracture, in producing temporary atrophy of the impoverished fragment. (*Medico-Chirurg. Trans.* 1837, vol. xx.) The question naturally suggests itself, whether this accident might not sometimes favour even the formation of a supernumerary joint.

In conclusion of this detailed, and it is feared, tedious investigation, we cannot help feeling, to some extent, the discouraging apprehension expressed on a similar occasion by a far more experienced and able writer, that "this review, however humiliating the reflection, is not calculated to afford any one precise information respecting the object of our inquiry."* Our end will be answered, however, if we have placed once more plainly before the profession, in a collected form, the principal conditions which may possibly give rise to the infirmity in question; and especially, if the readers of these pages who have paid little attention to the subject, shall be prepared not only to meet and avert them, but to watch closely their real operation, and report the results of such observations.

Anatomical characters.—We do not propose to enter at this place *in extenso* on the consideration of the anatomical characters, and the diagnosis and prognosis of the disorder under investigation. Suffice it to say,

* Hewson. (*Op. citat.*)

with regard to the anatomical varieties, that they are complex and numerous, as a matter of course, since they depend upon a primary lesion, which is itself the result of accident; and that they are arranged under two principal types.

The commonest of these is the *amphiarthrodial*, in which the fragments are directly connected through the medium of condensed cellular membrane, devoid of osseous matter. The second is said to be *diarthrodial* in character, although some writers still contend, with Boyer, that it presents nothing in organisation analogous to that of a genuine ball and socket joint. We are disposed to hazard the conviction that this difference of opinion might be shown to be more imaginary than real, as in fact verbal merely, and turning upon the logical meaning of the word joint. Certain it is, that many instances are on record, and specimens preserved, in which a sort of "bursal structure" had been formed. The articulated fragments may be unconnected except by a more or less complete, and sometimes decidedly fibrous capsule, which is attached by an irregular margin to their periphery above and below the respective ends; these ends may be rounded off and cicatrized into compact and smooth surfaces; they may be adapted to each other by concave and convex surfaces; or, it is stated, these surfaces may be encrusted by a sort of thin, pseudo-chondroid membrane; lastly, the ends are known to be sometimes lubricated by a fluid resembling synovia; and are said to be furnished with a synovial membrane. Such an arrangement of parts would seem, at any rate, to constitute an articulation, whether or not it possess any exact feature (besides the mobility and discontinuity) in common with the natural organs to which Boyer, (*Op. citat.*) Hewson, (*Loc. citat.*) Syme, (*Prin. of Surg.* part i, p. 245,) and more recently Chelius of Germany, (*Traité de Chirurg.* par M. J. Chelius, Trans. by J. B. Pigné, 1832,) have denied it a resemblance. The limits of this memoir, already somewhat transgressed, preclude our offering any observations in relation to the diagnosis and prognosis of supernumerary joint, even by way of illustration and introduction to the treatment.

Treatment.—In general terms, the object of the treatment of supernumerary joint must be, first, to counteract or remove the cause of the evil, should it still persist; secondly, to excite such an action in the part at fault as may lead to anchylosis of the joint, that is to say, to consolidation of the long disunited fragments. The removal of the cause, (releasing the limb, for instance, from the injurious confinement of a too tight dressing,) is sometimes, especially in the earlier or forming stage of the affection, enough alone to procure this consolidation. The eradication of a constitutional disorder; the invigorating influence of an improved diet and other tonic regimen, together always with the repose, (never to be left unsought for as soon as the requisite action is once started,) which is secured by the skilful employment of an efficient fracture apparatus; or finally, this repose, thus obtained, alone, has frequently sufficed without any other remedy.

A simple course of this kind was often pursued with happy results by Boyer. He confined himself, in many cases, to maintaining the parts quietly *in situ;* occasionally recommending a nourishing diet, and perhaps a mild tonic course of medicine. The following account is selected and condensed from those of five cases, which this surgeon gives as a few out of many, that he treated with success in this manner. A young man,

ætat. 19 or 20, enjoying good health, but thrown into a state of despair by having gambled away a large sum of money entrusted to him, jumped from the bridge of the Tuilleries into the river. He fell upon a raft, and broke his right thigh obliquely in the middle. The fracture was treated in the usual manner in the hospital La Charité. At the end of four months, the fragments, which had overlapped considerably, were still very movable. A number of operations were proposed for the relief of the man; but no plan was agreed upon till M. Boyer undertook the treatment. The limb was kept in a state of continual extension by the ordinary bandages, which were carefully tightened every day. In three months, that is to say, seven months after the accident, the fracture was firmly united. (*Malad. Chirurg.* t. iii, p. 98.) Velpeau speaks in the highest terms of an analogous, but perhaps more perfect treatment, by the aid of the immovable apparatus. A very extensive employment of this apparatus has convinced him that it will enable us to cure the greater number of false joints without any other operation, and in support of his views, he cites the practice of Larrey, Berard, Jr., Macdowel, Thierry, &c. M. Thierry cured, with the starch bandage, in two months, a pseudarthrosis of this kind that had existed for one year. Among other facts which Velpeau communicates from his own experience, we find the following. Mde. B. suffered a fracture of the humerus. Thirty months afterwards it was still flexible, notwithstanding the care of many distinguished surgeons of the capital, and the employment of all sorts of bandages. The dextrine was applied and left unchanged for two months; at the end of that time, to the great surprise of the patient, the removal of the dressings exhibited the bone in a state of consolidation. The same happened in a supernumerary joint of the femur, of ten months standing. (Velpeau, *Méd. Operat.* 1839, tome ii, p. 585.) Instances of similar good effects, from the use of the retentive apparatus of Baillif, are related by Troschel in Germany. With the immovable apparatus properly applied, says Velpeau, we can hope then to cure all pseudarthroses that are not maintained by a want of energy, a general disease, or a degeneration of the fragments; and all that are owing to the defect of sufficient contentive means.

But in the more formidable cases, although the original cause of the mischief may have disappeared, reparative action has entirely ceased; the parts exhibit no disposition to unite, and rather seek to adapt themselves to their new condition and relations. This state of things calls for a more energetic treatment than the passive method we have just described. A decided impression must be made in order to arouse the dormant regenerative forces of the implicated tissues. The excitement of a reproductive action, whether it be inflammatory in itself or not, is the leading indication.

Although there are many modes of attempting to answer this indication, yet they are all more or less uncertain, and frequently tedious and painful. Some of them subject the patient to great and protracted suffering, and may even place his life in jeopardy. The views of surgeons on the treatment as upon the etiology of this perplexing malady, are far from being firmly settled. Certain it is, that although none of the numerous and diversified methods of treatment recommended by different authorities, has been entirely discarded, yet there is scarcely any that has not at times, however faithfully pursued, greatly disappointed the practitioner. The multiplicity and varied character of these plans, together with their occa-

sional failure and occasional success, would appear to be sufficient, without recurring to the history of the causes, and of the various forms of the disease, to show that no remedy yet devised can be expected to answer the indications with uniform success in every case, or even in the majority of cases.

Oppenheim, in expressing sentiments to this effect, avers that an appropriate remedial measure, adapted to all the various forms of this injury, still ranks among the *desiderata chirurgiæ*. In the absence of such a measure, of course it becomes important, by more extended observation, to determine, with precision, by what circumstances as a general rule, the principal remedies are especially indicated.

These remedies are general and local. The first include regulated diet, tonics, alteratives, &c. They need not occupy our attention at any length since their administration must be governed by certain well known general principles. "According to the variety of causes, medicines shall be applied," are the words of Ambrose Paré in relation to this subject. They express a truism that requires no amplification.

As instances of the occasional service of constitutional means, even in patients of apparently good health, we have cases recorded in which the exhibition of mercury in small doses, combined with the usual mechanical treatment, has been marked by favourable results, after other measures had been essayed in vain. Salivation, however unnatural it may seem as a remedy for imperfect separation of bone, nevertheless, was practised with success, at least ten years ago, by Mr. Hammick. A marine with a fracture of the leg of several months duration, came under his charge. Having accidentally discovered that the man had been suffering less than 12 months before under severe syphilitic symptoms, he put him upon a course of mercury; and before ptyalism went off, the leg had firmly united. After cautioning his pupils against the indiscriminate use of this medicine, except in cases of venereal disease, lest it retard union by the debility it produces, he goes on to say—yet mercury will frequently be required by patients who have never had any syphilitic taint, not only as an alterative, but even pushed to a considerable extent before union of a fractured bone takes place. He then refers to a case of a marine with a fracture of the leg 17 weeks old, and still ununited. The man appeared to be in perfect health, and never had had any venereal infection. Camphorated mercurial ointment was locally applied until salivation was induced, when the callus speedily formed. So common is this treatment, according to him, that he does not think it worth while to dwell upon it. (*Op. citat.* p. 118.)

An interesting case of this kind, (in which, however, the treatment was complicated by the use of pressure, effected by a well-padded leather girth firmly applied around the seat of fracture,) is reported by Bransby Cooper. Mr. Cooper administered the mercury at the suggestion of Mr. Colles of Dublin, who had been struck with its effects in the Dublin Hospital. It was a fracture of the humerus near its middle, of six months standing, in a healthy female 28 years of age. Friction, the immovable apparatus, and the seton had severally been tried and failed. Hydrarg. cum Calc. Carb. gr. iv, ter die, was prescribed, and the leather girth directed to be worn. Salivation was produced; and when at the end of a month, they removed the girth, the bone was found to be perfectly united. (*Guy's Hosp. Reports* for 1837, p. 400.)

Dr. Hays has favoured me with the outlines of an interesting case in which constitutional treatment, combined with pressure and rest, effected a cure. Eliza Able, ætat. 26, entered Wills Hospital for the Lame and Blind, September 7th, with a fracture of the humerus of six months' standing. Friction had been employed without effect. Dr. Littell, under whose care as the then attending surgeon, she for a short time remained, produced an eschar three inches long by one wide with the potash on the arm over the seat of injury. The cauterised surface became a troublesome sore which required considerable attention, and occupied some time in cicatrizing. No material change in the relation of the bones was manifested. When she came under Dr. Hays's charge, on the first of October, he found that she was labouring under considerable constitutional derangement with disorder of the menstrual function—this discharge being irregular, and when present accompanied with severe pain, (dysmenorrhœa.) She also had leucorrhœa. He treated her for these complaints; and among other internal remedies, administered first iodine, and afterwards carbonate of iron in combination with quinine. At the same time, pressure and rest were maintained, the limb being dressed with an angular splint reaching from the axilla to the finger ends. The girl was discharged perfectly cured on the 31st of December following.

The *local remedies* are medicinal, medicinal and mechanical, or solely mechanical. They consist in, Irritating applications to the tegumentary surface in the vicinity of the joint, such as rubefacient liniments, tinct. iodine, lotion, douches, blisters, and escharotics. Irritating injections thrown into the cavity of the joint. Shocks of electricity passed through the seat of disease. Friction of the separated surfaces against each other; friction and pressure with exercise, constant pressure and rest. Exposure of the joint and irritation of the articulating surfaces and surrounding parts. Irritation of the joint with slight exposure by means of a long sharp-pointed instrument passed obliquely through the flesh down to the ends of the fragment. Introduction of artificial heat into the joint by means of a rod previously held in boiling water; cautery, actual and potential to the articulating surfaces; rasping of these surfaces; resection of the ends; resection of the ends, and binding together the fragments with a silver wire; lastly, the seton and its modifications.

All of these have been tried singly; and some in combination with each other, and with general remedies. Each with, perhaps, one or two exceptions, has its advocates who place it first on their list and point to their success with it in support of its claims.

External irritation has long been familiar to surgeons as the means of at least accelerating the deposit of callus. Paré recommended gentle frictions and fomentations with warm water, irritating plasters and "other things which customarily are used to members troubled with an atrophia." (*Loc. citat.*) He is very particular in directing the suspension of these when the parts begin to "grow hot and swell" lest they produce the opposite effect from that intended.

Heister also advises us to rub the limb well with hot cloths, spirituous medicine, aromatic lotions, &c., &c. Duverny tells us, that induration may be assisted by lotions of aromatic wines, and by the application of compresses moistened in them and retained by a bandage.

The Iodine lotion is of more recent date. It was proposed and successfully employed in the form of tincture, by Buchannan. Mr. B.'s first

case, was that of an oblique fracture of the bones of the leg, of 46 weeks standing, in a young man of excellent health and strong constitution. There was much displacement and overlapping of the fragments. After six months ineffectual trial of pressure and exercise of the limb, as recommended by J. Hunter, according to Sir E. Home, he proposed resection, but being overruled, finally determined to try the tincture of iodine. At this period, says the author, it was with the greatest difficulty and extreme pain that the patient could drag himself along with a staff. The limb was considerably swelled particularly below the fracture; and if when attempting to drag himself along he touched a stone or the least elevation in the path on which he was walking he was put to the most excruciating torture. The limb was shortened two inches and could be rotated to 8 inches at point of fractnre. April 16th. Applied tinct. to the limb particularly about fracture and parts around the ankle, and in three days the pain and swelling were removed. Patient took decoct. dulcam. ℥ii. t. d., which, by the bye, he had been taking from the outset. Continued tinct. every morning until May, and then applied it only every second day. Parts became stimulated and deposited osseous substance; union took place, and in the month of August following he was dismissed cured, with the limb apparently stronger than before the accident. The author adds in a note that the patient walked, (supported by a staff,) to his surgery every time the medicine was applied, so that part of Hunterian method as he calls it, was employed in conjunction with his own. (*On a new mode of Treatment for Dis. of Joints and the non-union of Fractures*, Lond. 1828.) The tinct. of iodine has been tried with benefit, by Willoughby in America, (*Trans. of Med. Soc. of St. of New York*, vol. i, 1834,) and Trusen in Germany. (*Med. Zeitung*, 1834.—See Oppenheim.)

The mineral water douche to the limb around the joint was proposed by Rognetta (*Archiv. Gén.* 1834, vol. xxxv): he ranks it with vesication and cautery. It was suggested to him by the account of Monteggia, (*Instituzioni Chirurg.* 1816, vol. v, p. 194,) of the experiments and observations upon the Springs of the Vardieri, of John Fantoni, an Italian Physician, who ascertained that the effect, upon animal matter, of these waters, when falling from a height, was much more penetrative and forcible than that of water of the same temperature in form of still bath. The spout baths of the Hot Springs, Va. U. S., which have long been noted for the relief of many chronic disorders, might be beneficial in this way. The waters of Barege and one or two others on the continent of Europe have the reputation of sometimes exciting the absorption of callus. Dr. Blutzke of Schwetz has lately shown, that the daily application for half an hour or an hour at a time of simple cold water descending upon the part from the height of six feet in a strong unbroken stream, is remarkably efficacious in the cure of old atonic ulcers of the feet; and even in herpetic ulcers and scrofulous caries of the lower extremities, one half the patients were cured by this douche. (*Amer. Journ. Med. Sci.*, Aug. 1840, p. 480, from *Med. Zeitung.*) Repeated vesication of the limb near the diseased part was proposed by Mr. Walker of Oxford in 1815, (*Lond. Med. and Phys. Journ.*, vol. xxxii, 1815,) and has since become a common and useful remedy in the tractable cases. It is said to have been resorted to for many years by veterinary surgeons in the management of analogous lesions of the bones of inferior animals. It was well esteemed as a moderately active and often very valuable therapeutic aid by Wardrop, Brodie, and others.

Escharotics externally applied in the region of the joint were introduced by Dr. Jos. Hartshorne of this city. (*Eclectic Repertory*, 1812, vol. iii.) He used the caustic potash for the first time in 1805. He rubbed it on the integuments near the seat of injury so as to produce a small superficial eschar with moderate inflammation; and by this means to excite the neighbouring parts. The case was that of a fracture of the external condyle of the femur, of four months' continuance. The man recovered the use of his limb in 20 days after the issue was created, although no previous treatment seemed to have had any effect. The second instance reported was a supplementary joint of the humerus five months after fracture, treated in the year 1811, for which pressure was used together with the alkali. In 1838 he was consulted in another case of supernumerary joint of the femur which was cured at his recommendation with the caustic and by pressure.

Possibly the moxa might be advantageously used in some cases where the bones are superficial.

The actual cautery has been found to hasten consolidation. Dr. Kirkbride tells us that it was applied with good effect to a fractured femur in the Pennsylvania Hospital. (*Amer. Journ. Med. Sci.* for Nov. 1835.)

External cautery appears to have been beneficial in relieving the patient of his infirmity when in such a situation as to render the prognosis as to ultimate recovery quite discouraging. Its success upon the femur and humerus—large bones deeply embedded in the soft parts, and therefore distant from the surface, would seem to show that it is superior in efficacy to vesication and other superficial applications, all of which are generally supposed to be inadequate, except where the bones are near the surface, and when the process of reparation has rather flagged than entirely ceased, or given way to another action. It has, moreover, the advantage of being available when, as in the case of jointed condyle, an operation would be contra-indicated by the proximity of a natural articulation or a large nerve or artery. Velpeau considers it like the rest of its class only adapted to the unconfirmed stage of the malady, and not sufficiently prompt and energetic in its operation to alter the disposition of the parts. (*Loc. citat.*)

Stimulating injections were proposed by Dr. Hulse of the U. S. Navy, (*Amer. Journ.* for Feb. 1834,) in supernumerary joints complicated with a fistulous opening. He effected a cure in two months of a case of this kind, in which port wine and water, salt and water, and a solution of sulphate of copper were successively employed. A solution of iodine is recommended by Dr. Norris as probably the best injection for this purpose.

Electricity was adopted by Mr. Birch, one of the surgeons of St. Thomas's Hospital, in whose hands it was eminently beneficial. He informed Dr. Stevens of New York, on whose authority these statements are made, that it had never failed with him. "One of his dressers, with whom I was intimately acquainted," says Dr. Stevens, "saw two cases in which it produced the most happy effect." "One of these patients," continues Dr. S., "whom I afterwards visited during his illness, entered St. Thomas's Hospital, in the month of January, 1812, with an unconsolidated fracture of the tibia, below the middle, of 13 months' standing. The leg below the fracture could be easily moved in any direction, and without exciting much pain. Shocks of electric fluid were daily passed through the space between the ends of the bones both in direction of the length of the limb and that of its thickness. The man being somewhat weak used

bark and porter at the same time. The leg was retained in the ordinary fracture dressing. Improvement was very perceptible in two weeks, and in six weeks he left the hospital cured." (Append. to *Trans. of Boyer*, note A.)

The remedial measures that we have just described, together with friction and pressure, (with either or both of which they may be sometimes advantageously associated,) form a class of themselves, some of which, according to his own views, the surgeon first tries in his efforts to bring about the union of an indolent or chronic fracture, before he makes up his mind to resort to more formidable expedients. Accident may induce what these latter are designed to effect. Seerig relates a case, in which the patient who had refused all treatment, was attacked unaccountably with an erysipelas of the limb; this soon produced the restoration of its bony continuity. Erysipelas has been observed, in the Pennsylvania Hospital, to operate in a similar manner, (Kirkbride, *Amer. Journ. Med. Sci.* for Nov. 1835.) Wardrop tells us of a sailor in whom a fracture of the humerus evinced no disposition to unite until three weeks after the injury, when he happened to fall and severely bruise the limb; after which, union rapidly advanced. (*Medico-Chirurg. Trans.* vol. v, 1814.) Amesbury reports an analogous incident. A gentleman had a fractured thigh in which no union could be established: several months after his mishap he was thrown out of his gig, and the wheel passed over the limb at the fractured part. He was confined after the second accident, which was followed by high inflammation; and now the fractured bone united. (Amesbury, *Op. citat.*) Meeker narrates an interesting case, the following sketch of which is condensed from his account. A lady fractured the radius of her right arm. Through the inattention of her physician, who did not suspect a fracture, a supernumerary joint was allowed to form, which rendered the use of the limb difficult and painful, unless it was supported by a roller. Nearly four months after the reception of the injury, she unexpectedly met with an intimate friend, and forgetting herself, in the joy of the moment, she gave him her right hand; the cordial shake which it received, produced such excruciating pain from the friction of the two ends of the bone, at the point of separation, as to cause an involuntary scream. The arm remained sore, and in a few days, slight lancinating pains were felt in the part, which continued for some time. At the end of three or four weeks, she was astonished to find the roller no longer necessary, the bone having firmly and securely united. (*N. Y. Physico-Med. Trans.*, vol. v, 1817.)

This is in fact the history of a case treated purely by the use of friction; of the operation of which it is a striking illustration. Forcible and, if need be, repeated attrition of the articulating ends of the fragments, until inflammation sets in, is the most simple and, excepting pressure, the safest of the strictly chirurgical remedies for supernumerary joint. It was recommended by Celsus, (lib. viii, cap. x,) and is the oldest among them. It does not appear to have been much thought of, until Mr. White, of Manchester, recalled the attention of the profession to it, and urged its merits. Duverney, early in the last century, spoke of it as recommended, but considered it, to use his words, "only good in the study, for, however the whole end of the cemented bone be rubbed, it is useless and even dangerous for the patient." (*Op. citat.* p. 176.) Friction was stigmatized also by Boyer as extremely improper, where the consolidation was not definitely suspended; because it retards the process of nature by

breaking up the callus already deposited; and as futile in a confirmed supernumerary joint, while it leads to serious accidents by tearing the adjacent soft parts. (*Op. citat.*, tome iii, p. 106.) These theoretical objections have not been sustained by later observations. We know of no instance in which serious consequences have resulted from the employment even of some violence in rubbing the bones upon one another. Boyer's strictures are chiefly levelled against what would be manifestly an abuse of the remedy. It would certainly be wrong to continue the repetition of the friction after a decided irritation was produced; or to omit to enforce the most perfect quietude immediately and for some time after the symptoms of high action had appeared.

The case of Dr. I. Parrish, and those of Dr. Kirkbride reported in Nos. xxviii and xxx of the *Amer. Journ. of Med. Sci.*, are well marked instances of its successful employment. Sanson brought about consolidation in a femur obliquely fractured and much shortened, that had remained ununited for more than a year, merely by the friction incident to the reduction of the fragments which overlapped each other five or six inches. (*Dict. de Méd. et de Chir. Prat.*) Derricagaix cured in 40 days a supernumerary joint of the leg of six months duration, by violent friction of the surfaces. (*Recueil Périodique de la Soc. Méd.*, tome ix, p. 314.) Steinheim relates a cure of a similar joint of the femur by the same means. (*Med. Zeitung.* Oct. 1834.)

White, of Manchester, firmly enclosed the thigh in a leather girth adapted to the whole limb from the patella to the groin, and then directed the patient to make some use of the limb in moving about. He thus combined pressure with exercise of the limb, and with great friction. The patient thus treated was ultimately relieved, but not without much trouble, on account of an abscess that formed in the joint, and prostrated him to an alarming degree. (*Op. citat.*, p. 76.) This method was recommended by John Hunter and Sir E. Home. (Brodie, *Op. citat.*, p. 57.) Inglis adopted it with advantage in 1805. (*Edin. Med. and Surg. Journ.* vol. i.) This gentleman made considerable pressure by means of a roller and a tin plate. Brodie has known the best results to follow, where patients who have been confined to their beds for 10 weeks or more, without consolidation of their fractures, have been permitted to hobble about on crutches, and subject the maimed limb to the weight of the body after having had it protected with a sustaining apparatus. According to Oppenheim, (*Op. citat.*,) Professor Kluge, of Berlin, allowed his patients to use a limb, if it remained flexible after the lapse of the period usually occupied in restoration; and in the event of inflammation remanded the individual to his quiescent state. In every instance, a quick and firm consolidation resulted without suppuration. Malgaigne tells us that Boyer, and also Briot, in France derived full success in several cases, from this mode of treatment. (*Méd. Opérat.*, p. 248.) Velpeau states that he has often resorted to it, and quotes MM. Champion and Jacquier d'Ervy in its behalf. (*Op. citat.*, tome ii, p. 583.) "It is generally thought," says Sanson, in reference to friction, (whether simple, or combined as just described, for he makes no distinction,) "that this means, much as it has been approved by distinguished men, and in despite of the examples of cures obtained by it, in our possession—suits only in the preliminary stage of the organization, and when the fragments correspond end to end. It seems, indeed, that it must make little impression on the articular cartilages of the new formation once

fully developed, or on the fibrous substance sometimes serving to connect the bones. (*Op. citat.* p. 500.) Oppenheim and Amesbury in some degree concur with him in these views. He admits, however, that it sometimes happens, that even when the fragments correspond only by the side, a very slight rubbing suffices to dispose them to reunite: and instances the case in point which we have already quoted. Dr. Norris exhibits in his tables the analysis of 10 cases, all of which were cured in the manner just discussed.

Greater benefit has been alleged to accrue from the employment of firm and regular compression associated with rest, which has been so pre-eminently useful in the hands of Mr. Amesbury. If not the originator of this method, Mr. Amesbury has done a great deal towards establishing it as an independent and important mode of treatment. This gentleman's array of successful cases (to the amount of 16 out of 17 detailed, besides many others not enumerated,) in his own practice affords strong support to his position in relation to the superiority of his treatment. It has found staunch advocates in Brodie, Lonsdale, and others, in Great Britain, and Wright, of Baltimore, in America, each of whom has repeatedly satisfied himself of its favourable operation. It has also succeeded in France and Germany. Dr. Norris's summaries present 25 cures and 1 partial cure out of 28 cases treated in this manner. The compression of the fragments and their comparatively perfect rest in close apposition, are effected in various ways according to circumstances and the preference of the operator. The common roller, padded splints, compresses, and the tourniquet constitute the materials of an excellent apparatus always at hand. Mr. Amesbury is in the habit of using the fracture machines invented by himself, by which he can press the fractured surfaces in any direction against each other, at the same time preserving them from the slightest motion.

The simplicity, ease of application, slight inconvenience, as well as perfect safety of this plan of treatment, no less than the amount of evidence in favor of its efficiency have gained it an extensive adoption. Some persons are ready to believe it destined to supersede the seton and all the severer remedies. Nevertheless, it is not without strong opponents; Liston among others decries it as useless, and Oppenheim thinks it the least applicable plan, because where it has cured, the same end could have been achieved by less troublesome and tedious means. When, continues this author, no cure follows, the condition of the patient is not, as Amesbury, Brodie, &c., declare, the same as previously. For, besides the loss of time incurred, the disease is materially exacerbated, the joint being actually more strongly developed. He asserts that the expedients of Mr. Amesbury are only capable of fulfilling completely the indication to keep the fragments quiet in their respective places, and can but very partially and uncertainly create the inflammation, which he (Oppenheim) considers so vitally essential to the renovation of the bone. Nor does he forget to remind us that Brodie himself confesses that frequently no fresh inflammatory action is excited, and that he has met with cases where no union had occurred at the conclusion of the treatment. Velpeau also insists on attributing the success of pressure and rest, especially as practised by Wright, merely to the more complete immovability of the limb secured by the instruments adopted. Amesbury himself has been disappointed in some instances, and acknowledges that his method is not to be relied upon in certain cases. It is apt to be inert on a loose joint with a thick adventi-

tious capsule, or where there is a considerable mass of condensed cellular and chondroid membrane between the fragments. There are instances also in which the displacement of the fractured ends is so great as to put the use of pressure and rest out of the question. But there are other cases to which it seems peculiarly adapted; such are those where there is a large and irregular callous tumour, together with angular displacement or extensive overlapping of the bones. Examples of these deformities, in which splints and the tourniquet were employed with the most gratifying results are reported by the author of the treatment, as well as by Brodie, Syme, &c., &c., and still more recently by Norris in the Pennsylvania Hospital of this city.

The following data are taken from the summaries appended to the very valuable unpublished statistical tables of Dr. Norris, to whom our readers are already indebted for other interesting matter of the same nature.

Of the 28 cases in which pressure and rest were used—

10	were on the	Femur	of which 8	were cured.
5	"	Leg	" 5	"
10	"	Humerus	" 7	"
3	"	Fore-arm	" 3	"
28			23	

The longest period that the fracture had existed in the above cases was 66 weeks (femur.) The shortest was 4 weeks, (fore-arm, ætat. 12.) The longest period required for the cure was 5 months, (humerus, ætat. 24.) The shortest was three weeks, (humerus, ætat. 53.)

We come now to the operations on the bones themselves. That of John Hunter, (if we except the seton as employed by Physick,) is the simplest. All that was necessary in his view was to lay open the cavity of the joint, and irritate the ends of the bone involved in it. (*Principles of Surgery*, Palmer's ed. vol. I, p. 504.) Brodie (*Op. citat.* p. 57,) cites a case in which this was successfully resorted to by Sir E. Home. The editor of Hunter's Surgery (*Loc. Citat.*) states in a note that this operation had lately failed in two cases at St. George's Hospital. Sir C. Bell proposed to effect the requisite irritation with the smallest possible external opening by the aid of a long and sharp instrument to be pushed obliquely down upon the bones. "By this means," said he, "I imagined the wound made by the transit of the instrument would immediately heal, and yet the extremities of the bone be so excited as to resemble the state of simple fracture more than could possibly happen after cutting down upon and sawing off their ends. (*Operative Surgery*, vol. II, p. 326.)

Hot Iron.—Mayor, in a case of obliquely fractured femur of 7 months standing, and in which friction and pressure had proved unavailing, succeeded in stimulating the bony surfaces and surrounding tissues into a disposition for reunion, by subjecting them to heat through the agency of an iron rod heated to the boiling point of water. The canula of a large trocar was introduced between the oblique ends of the fragments, and left 8 hours in place. Through it a stylet of iron which had first been held in boiling water was repeatedly passed. (*Nouveau Syst. de Déligat, Chirurg.* 1838, p. 304.)

Escharotics.—White, of Manchester, in his second case of resection rubbed the new surfaces of the bone with the butter of antimony. Mr.

Cline was probably the first to use caustic applications to the fragments without previous excision of their ends. Since then it has been employed by Greene and others in Great Britain, by Hewson, Barton, Harris, Kirkbride, Norris and others in America; and, according to Oppenheim, by Ollenroth and Weilinger in Germany, and Mayor in France. Fuming nitric acid, caustic potash, butter of antimony and nitrate of silver have been severally tried. Hewson in his case removed the dense cellular membrane connecting the fragments, with a knife before he touched them with the alkali. Norris's case was the sequel of an oblique fracture of the humerus near the condyles, attended with overlapping. The joint was very loose and had existed four years, during five or six months of which friction was persevered in without avail. The transmittal of a seton between the fragments, proposed as the next most promising plan of procedure in this case to friction was rejected in consultation, owing to the close proximity of the ulnar nerve and humeral artery, as well as the elbow joint, to the course it must have taken through the injured part; and because the records of surgery exhibit many failures of the seton in cases of long standing. "In these latter cases," continues Dr. Norris, (whose language we have endeavoured to preserve as nearly as practicable, in the foregoing and succeeding passages,) "excision of the ends of the bone, or the application of caustic after free exposure of it are the means most to be relied upon. The first of these, besides, being a much more formidable operation, and productive of more pain and danger than the latter, would have been in the highest degree difficult, if not altogether impossible, in the case before us, from the nearness of the false joint to the elbow." The seat of the previous fracture was laid bare—the thickened cellular substance connecting the two ends of the bone was then cut through, and the wound carefully dried; after which caustic potash was freely rubbed over them *until a black eschar was formed.* The limb was dressed and treated as for a compound fracture. With the exception of one or two attacks of hæmorrhage attributed to idiosyncrasy, no bad symptoms presented; and in about three months the bone had become perfectly firm. (Report of Surgical Cases, at the Pennsylvania Hospital, *Amer. Journ. Med. Sci.*, February, 1839.)

Rasping.—Cutting down upon the fragments, scraping the opposing surfaces, approximating them and treating the injury as a compound fracture, was a method known to the Arabian physicians. Avicenna declares, that Hali Abbas witnessed the death of a philosopher in consequence of such a mode of treatment. Guy de Chauliac blames this philosopher for having acted very foolishly, in not contenting himself with his lameness. (Boyer, *Malad. Chirurg.* vol. iii, p. 105.) This operation was performed by Vincent in London on a joint of both bones of the fore-arm. Death followed on the fifth day. (*Lancet*, vol. xiii, 1827.) Scraping the ends, and retaining lint between them was practised with a more fortunate issue by Brodie in 1834. (*Lond. Med. Gaz.*, July, 1834.)

M. Barthelemy suggested that the ends of the bone should be scraped by a rasp in the form of a saw, conveyed down to the fragments by means of a canula. (*Velpeau, Op. Citat.*, tome ii, p. 588.) A Dutch surgeon, named Vander Haar, according to Oppenheim, "very unwisely" proposes the exposure of the articulating surfaces, scraping them with the trephine, and then covering them with the butter of antimony, as the only remedy, except resection capable of accomplishing a restoration to health.

Resection or Excision of the Ends of the Fragments.—This is confessedly, one of the most dreadful operations in surgery. Boyer believed that it was familiar to the Arabian physicians, and based his opinion on a passage which he refers to in Avicenna. Dezeimeris, although he asserts that Boyer misinterpreted this passage, informs us that, in another place, Avicenna does describe the operation. (Dezeimeris, *Dict. de Méd.*, tome xiii, p. 500.) Be this as it may, there is a case described by J. L. Petit, (*Dis. of Bones*, p. 358,) in which that surgeon effected union in a fracture complicated with caries by removing the carious portions of the jointed bone and subsequently applying the actual cautery to its diseased extremities. But to White, of Manchester, is unquestionably due the merit of having introduced resection in modern times, and made it a distinct and definite radical operation. He cut down to the bones upon their most accessible side, carefully avoiding large nerves, arteries, &c., exposed, and if necessary, turned out the ends of the fragments and removed them by means of a saw. Then readjusted the fragments, bringing together the raw surfaces as in the operation for hare-lip, and afterwards treated the wound as a compound fracture. The details of the operation as to the mode of performing it, the instrument (chain saw, &c.) used, and the amount of bone removed have varied from time to time in different hands; but the general characteristics are essentially the same in every instance. In his second operation, White contented himself with excising one extremity, merely irritating the other. Inglis, Dupuytren, Syme, and others, have followed his example, and have in this way more than once considerably diminished the difficulties, sufferings, and dangers of the operation without sacrificing its efficiency.

Such is the character of resection, as one of the gravest operations, that few surgeons of the present day are willing to undertake it under any circumstances, without considerable hesitation. The majority regard it as, at best, but a last resort in preference to amputation, and only to be attempted in the most promising cases, and at the urgent solicitation of the patient. Some writers on the subject reject it altogether. Among them are Boyer, Richerand, Larrey, C. Bell, Wardrop, Brodie, Amesbury, Liston, Oppenheim, &c.; and Physick, Dorsey, Gibson and others, of this country, all of whom oppose it on the ground that it is tedious, painful, often extremely difficult, and apt to be followed by a reaction so violent as to expose the patient to great suffering and danger for a length of time, if it do not involve his life. While in the end, a cure cannot be confidently looked for, and at all events, must generally be expected only at the expense of a shortened limb. Sommé denounces it as barbarous; and describes a case witnessed by himself, in which, after a tedious and very difficult operation, long confinement, with free suppuration, troublesome hæmorrhage, and great trouble in keeping the bones in place, no union was obtained.

Rowlands, of Chester, England, after having successfully performed the operation on the femur, remarks, "Though I have several times performed all the principal operations in surgery, and many of them very often, I confess this far surpassed any thing I had ever undertaken or witnessed, and I am doubtful as to the propriety of recommending it to others." (*Loc. citat.*)

Gouraud calls it a retrograde step in surgery; Velpeau, from whom we quote Gouraud's opinion, in speaking of the very serious nature of re-

section, refers to a case given by Vallet on the authority of M. Gable, of an excision of the two extremities in a supernumerary joint of the femur. The operation was bloody, and lasted more than an hour; the patient, who was young and vigorous, had convulsions, and died in the evening. (*Méd. Op.* p. 589.) The number of published failures as given by Oppenheim, Velpeau, Norris and others, even supposing there were no unsuccessful cases, all accounts of which have been suppressed, show that a large proportion of the trials of this remedy have disappointed the operators, while some of them (not a few, considering the little real necessity for incurring the risk) were fatal.

Resection has been performed by many distinguished surgeons, on both sides of the Atlantic. They have at different times made each of the long bones of the extremities, also the inferior maxillary bone, the subject of it. Oppenheim, in summing up the cases of supernumerary joint, known by him to have been treated in this way, found that of 37 cases, 21 proved successful and 16 fruitless, 4 of the latter having been fatal; 17 out of the 37 were joints of the humerus, 6 only of the 17 recovered, and 3 died. Dr. Norris has made an abstract of the general results of 28 cases, (many of which are also included in the summaries of Oppenheim,) which is, however, more favourable to the operation. 20 of them were cured, 1 partially cured, 3 were not benefitted, and 4 died. Of these,

9	were on	the	Femur,	of which 6	were cured.
4	"	Leg,	"	3	"
8	"	Humerus,	"	6	"
6	"	Forearm,	"	5	"
1	"	Jaw,	"	1	"
28				21	

The longest period that the fracture had existed in the above cases was three years, (lower jaw.) The shortest do. was three months and twelve days, (radius, ætat. 26.) The longest period required for the cure was thirteen months, (femur, ætat. 26.) Shortest, one month, (forearm.)

According to the appreciation of Velpeau and some others, excision of the ends is the only efficacious remedy in disease of the bone, such as hydatids, caries, necrosis, &c., and in old fractures where the extremities of the fragment have become engaged in the soft parts so as to prevent their reduction and coaptation. At all events, says Velpeau, (*Op. citat.* tome ii, p. 592,) we ought never to decide upon it before having well weighed the dangers. Obliging us to penetrate even to the centre of the limb, to separate and dissect the flesh to a considerable extent, it transforms the affection into a recent complicated fracture, with a deep wound; whence the risk of suppuration, erysipelas, inflammations of every kind, caries, necrosis, and even of purulent infection and phlebitis. This advice is to the same effect as that given by Sanson and Vidal de Cassis, and accords with the views entertained by the greatest number of good surgeons. Yet Hammick and a few others continue to regard resection as the only efficient remedy in cases requiring any operation.

Dr. J. Kearny Rodgers, of New York, has increased the complexity of the operation and the after treatment, and enhanced their dangers by not only excising the ends but drilling a hole in the extremity of each frag-

ment, through which he passes a silver wire to bind the bones together. Dr. Heard reports a case of supernumerary joint of the humerus, another of the radius, and a third of the femur, for which this mode of treatment was resorted to successfully in the New York Hospital. He also cites a successful operation of this kind upon the humerus, by Dr. Mott, and another on the humerus by Dr. Cheesman, but gives no particulars. The first case reported by Dr. Heard was that of a lad of fifteen, who had fractured his humerus two inches above the elbow, more than two years before. He had worn the seton seven days at one time, and six months at another, without benefit. On the 31st of July, (1827,) Dr. R. removed half an inch of the extremity of each fragment, but finding it difficult to retain the fragments in apposition after having with some trouble reduced them, he drilled a hole into the medullary cavity through the shell of each end; through these holes a silver wire was passed, and the ends of the bone retained in coaptation. The ends of the wire were drawn through a canula which remained in the wound. On the sixteenth day the canula fell from the wound, with the loop entire; the bones, however, continued in proper position. The arm was not examined for a month; during this time the wound had almost healed. Union was found to have taken place in sixty-nine days. Patient was not allowed to leave his bed for two months after the operation. The arm was two inches shorter than its fellow. Case 2d, was a German, ætat. 26, with a joint of the radius two inches above the radio-carpal articulation. The ends of the fragments were removed with the bone pliers. A hole was now drilled into each extremity; and a silver wire being passed through, the bones were approximated by twisting this, the ends being allowed to hang from the wound. The wire came away with the loop entire on the thirteenth day; union was complete in eighty days. The third case was an interesting one, presenting in the previous accident an unusual assemblage of severe and complicated injuries. A man, ætat. 28, of strong constitution and perfectly temperate habits, was brought into the hospital with a compound fracture of the bones of the forearm; a compound fracture of the bones of the left leg; a fracture of the right os femoris, near its middle; and severe and extensive lacerations and contusions elsewhere, on the head, trunk and extremities. The fracture of the leg united in eight weeks; union also took place in the fore-arm. Nine months after the receipt of the injury, resection was performed upon the thigh by Dr. Cheesman. The fragments were reduced by the aid of powerful extension and counter-extension, and retained in apposition by means of the twisted silver wire. The operation occupied one hour and a half. The limb was dressed as in the other cases, with an appropriate apparatus. An attack of erysipelas followed this operation, with the exception of which the patient did well. The wire having nearly made its way out, was removed on the 69th day, the bone apparently united. Perfect union was found to have taken place on the 95th day, with the limb two inches shorter than the other. (*Heard on Ununited Fractures, N. Y. Journ. of Med. & Surg.*, Oct. 1839.) Resection and the wire suture have been recently tried with satisfactory results in France, by M. Flaubert, of Rouen, upon a supernumary joint, in which the fragments could not be kept in contact. "The idea," says Malgaigne, who notices the case, "appears to me very ingenious, and susceptible of many other applications." (*Méd. Opérat.* p. 249.)

Liston has discountenanced this operation as more apt to lead to necrosis

than to consolidation of the fragments. His objection, that it is too artificial and liable to produce necrosis by the exposure of the bones, and their greater or less denudation of the periosteum, still appears, we confess, extremely plausible, notwithstanding the counter representation of Dr. Heard. A greater number and variety of instances of success than even the well marked ones already quoted, we think, are needed to establish an operation so adverse to all our theoretical notions, and withal, so full of pain and peril. If the wire be intended solely to retain the fragments in apposition, it might be asked whether this indication may not be fully met in the great proportion of instances, by the aid of a proper apparatus without necessitating the recourse to such a painful, hazardous, and not positively certain expedient. This method is liable, in the fullest extent, to all the objecjections preferred against resection, while the data are insufficient to determine its superior efficacy. The idea of employing wire to connect the fragments of a broken bone, whether after resection or without it, is not by any means new, as supposed by Dr. Heard. M. A. Severinus long ago proposed to freshen the edges of the fragments of an ununited patella, and then to tie them tightly against one another. (Velpeau, *Op. citat.* tome ii, p. 591.) The *Journ. de Med.* (par Roux, tomes xliii, xliv, xlv,) for 1775, contains a violent controversy between two surgeons of Castres, named Icart and Pujol, respecting an operation to approximate the fragments of a broken bone, and to bind them together with a leaden or silver wire. Jeart maintained its feasibility in certain cases, which he describes, and states that he has seen it performed with success. Pujol strongly condemns it, and asserts it to have been fatal in one instance. In 1818, M. Dupuytren employed platina wire in this way, (though without passing it through the substance of the bone,) in a supernumerary joint of the lower jaw of nearly three years' standing. (*Leçons Orales*, tome iv, p. 669.) He resected the posterior fragment, rasped the anterior, and secured the two in close apposition, by means of a platina wire passed around the teeth. The practice had been vaguely suggested in 1805, by M. Horeau in a similar case. (*Journ. de Méd. Chirurg. et Pharm.*, in 40 vols., vol. x, p. 197, 1805.) Some three or four years since, a surgeon of this city attempted to produce bony union of a fractured patella, by passing a wire through a hole bored in the fragments, and thus binding them in apposition. Violent local and general reaction followed, and the patient succumbed on the fourth day. Malgaigne very recently treated a fractured patella with happier results, by means of a sort of very fine pointed iron clamps, so contrived as to be fastened together, while they firmly held the fragments by their points, (two to each clamp,) which had been pressed through the integuments into the substance of the bone. Although, as far as we are informed, no harm resulted from the last described experiment, we may confidently predict that few operators will have the hardihood to repeat either of them.

The Seton and its Modifications.—The honor of having first applied this invaluable remedy to the treatment of supernumerary joint is well known to belong to Dr. Physick. He used the seton for the first time in 1802, at the Pennsylvania Hospital. About three years after, the same instrument was resorted to with success in the treatment of a compound fracture of the thigh of long standing by Baron Percy at Augsburg.

The new application of this well tried therapeutic instrument was hailed upon its announcement as a brilliant improvement in modern

surgery, and welcomed as the long desired substitute for the more sanguinary measures. It has been tried by many surgeons, and with various success. Like all remedies, and especially like the remedies for this infirmity, to all the varied characters of which no single one has yet been found to be adapted, it occasionally fails. Yet it still maintains a high reputation as more rational than the other remedies in which the knife is resorted to, because it is simpler, less difficult, less painful and safer than either of them; while it is as often, if not more frequently effectual. It is extolled by Allan, Wardrop, S. Cooper, Liston, Mayo, Rognetta, Weinhold, Portal, Oppenheim and others in Europe, and by Physick, Dorsey, Mott, Gibson, Hays, and others in this country. On the other hand, Boyer, Zang, Brodie, Hammick, Amesbury, Lawrence, &c., decry it as, at best, of doubtful utility. The last named authority condemned it without reserve as an abandoned operation, which had been performed some two or three times with indifferent success. In answer to this "cavalier dismissal" of a well established mode of treatment, Dr. Hays soon afterwards published in the *American Journal of Med. Sci.* for November, 1830, a very interesting and valuable summary of 13 different cases successfully treated with the seton, which he collated from the works in his private library alone without any more extended research.

Oppenheim prefers the seton to resection, 1st, because it cures generally without shortening. 2d, because it produces a less prejudicial constitutional and local impression, and can never endanger life. He remarks, that on account of its mild influence, it has hitherto been employed in a number of cases in which it was not clearly indicated; as for instance, where the fragments were united by a broad cartilaginous mass, or by a genuine artificial joint, *i. e.*, a bursal structure. In regard to this, experience has shown that the common seton is not always to be relied upon in supernumerary joints of long standing, still less useful can it be in cases (comparatively speaking not very rare) in which the disposition of the fragments in the soft parts, is such as to prevent their requisite approximation. In the first mentioned class of unpromising cases, the modifications of Oppenheim, those of Gulliver and Rhynd, or that of Sommé, each of which will be noticed directly—may be found useful by the practitioner. Dr. Physick himself discouraged its use in supernumerary joints of the thigh, and he has, in some instances, advised against it in similar joints of the bones of the leg. Two of the instances of ill success in the application of the seton to the thigh, given by Dorsey, might, from his own account of them, be attributed in degree, at least, to the unfavourable disposition of the fragments. In his own words, "it was found impossible to bring the bones nearly together."—(*Dorsey's Surgery*, vol. ii, p. 117.) The summary of Oppenheim, (which, however, it must not be forgotten, is, like the others, quoted in this paper merely numerical, and to be received accordingly,) would seem to show that in the operation with the seton as well as that of resection, the greater number of failures have been met with on the humerus. Of 48 cases in which the seton was applied, 26 were cured, and 22 remained uncured; 2 of the latter died. The seton was tried in 16 cases of joints of the shaft of the humerus; only 6 of these were benefitted, and death followed in two instances of the remaining ten. From Dr. Norris's valuable statistics, for the use of which we must again express our acknowledgments, it appears that—Of 30 cases in which the seton was employed, 23 were cured, 3 partially cured, 3 received no benefit, and 1 died.

10	were on	the	Femur,	of which 7	were cured.
5	"	Leg,	"	5	"
9	"	Humerus,	"	5	"
5	"	Forearm,	"	4	"
1	"	Jaw,	"	1	"
30				22	

Of these 30 cases, 14 are stated to have had an incision made down to the bone previous to the introduction of the seton, and 15 had it passed without a previous incision. Of the 14, 11 were cured, 2 amended, and 1 died. Of the 15, 11 were cured, 1 amended, and 3 failed. In one case included in the above 14, the seton was passed through a previous fistulous opening. The longest period that the fracture had existed in these cases was $2\frac{1}{2}$ years, (femur, ætat. 28.) The shortest, was 2 months, (humerus, ætat. 24.) Longest period that seton was allowed to remain in, was 13 months, (humerus, ætat. 48.) Shortest, 7 days, (forearm.) Longest period required for the cure was 5 months, (femur.) Shortest, 1 month, (leg, ætat. 24.)

These summaries include some of the cases treated by the modifications of the seton which yet remain to be noticed. It is well known that in the United States the seton has been so long considered a remedy of unquestioned powers, that it has proved successful in many instances, which the operators have not thought it worth while to publish. The probable number of such facts, known only to individuals, may perhaps be taken, at all events, to balance the weight of the failures which have been consigned to oblivion.

There are different modes of using the seton, as well as modifications of the instrument itself. Dr. Physick passed it through the joint by means of the seton needle alone, without a previous incision; and always preferred this mode when practicable. He was particular also in directing that the seton should not be withdrawn, for weeks or even months, unless the bony union be found to have fairly begun. A want of attention to this rule of practice has been suggested, as probably the occasional reason for disappointment in the use of the seton. (*Dorsey's Surgery* and *Gibson's Outlines of Surgery.*) Liston, however, one of the strongest advocates of this remedy, entertains very different views. He would have us cut down upon the fracture, dividing the soft parts as little as possible, introduce a perforator between the ends of the bone, and turn it well round, then insert a seton, not caring that it should go exactly betwixt the ends of the bone, because he would rather pass it over the surface of the broken ends, and perhaps one on each side. Shake the limb a good deal about, and move the instrument rather roughly. The object is to excite a good deal of action; when that has been done, agreeably to his belief that the seton has done all the good that possibly can be attained by it, and that by remaining longer in the wound it would weaken the powers of the part, he withdraws it, and directs the ordinary treatment for a recent fracture. By this process, and also by increasing the size of the seton, and smearing it with a stimulating powder, (Hyd. Oxid. Rubr.) he has succeeded in several instances. (Clinical Lectures on Fractures, *Lancet*, April 30th, 1836, p. 176.) Oppenheim, believing that the single seton was in many cases incapable of producing adequate reaction proposed to em-

ploy two setons, one lying in contact with each bony surface. In two cases of false joint of the humerus, in which he adopted this plan with the most gratifying results—in one of them the common seton had been fairly tried—he operated in the following manner. He made an incision on the outer side of the arm down to the bone, then, by a rotatory motion, passed a common prismatic seton needle through the mass of flexible substance immediately in contact with the surface of the lower fragment; next he drew repeatedly, to and fro through the opening just made, a thick silk seton, which was fastened on the forearm. The second seton was then applied in the same manner to the upper fragment, and fastened on the shoulder. (*Op. Citat.*) Prof. Weinhold, at Halle, proposed to increase the irritation, and, at the same time, protect the bones from the injurious influence of the air by a funnel-shaped wound and a wedge-shaped seton. A wound an inch long was made down to the joint, the connecting membrane having been perforated with a needle trephine, through the eye of which had been passed a piece of tape with the cuneiform seton appended; this last was drawn by means of the needle and tape, (which were brought out through the integument of the opposite side of the limb,) so as entirely to fill the vacant space between the extremities. He reports 3 examples of this method of treatment, 2 of them successful, the second a joint of the femur 10 years after fracture with caries and fistula, and a third fatal, owing to previous caries of the acetabulum. (*Med. Recorder*, Jan. 1828, p. 178.)

For a joint of the tibia, eight months after fracture, in May, 1838, M. Saurer passed a seton, not between the fragments, but around their margin at the breach of continuity. Having cut down to the bone internally and externally at the seat of injury, he introduced a seton, half an inch broad and somewhat curved, through the outer opening around the fractured portion of the bone, and drew it out through the internal wound; in less than three months after the operation the patient was well. (Oppenheim, *Op. Citat.*) In 1835, Mr. Gulliver proposed that, in the treatment of artificial joints if the seton be employed, there should be two, one of which should be placed around each fragment, at a *short* distance from the line of fracture, because it is in those points that the deposition of bony matter commences. More recently, Mr. Rhynd, of Dublin, instead of passing the seton between the disconnected ends, so directed it as to leave it in contact with a considerable portion of their circumference. He has twice employed it in this manner with complete success. (B. Phillips's *Lect. on Surg.*, *Lond. Med. Gaz.*, May 22d, 1840.) In 1828, M. Sommé, of Antwerp, produced the consolidation of an oblique fracture of the femur, the fragments of which overlapped and moved on each other six months after the accident. He employed a silver wire, used somewhat like the ligature in the treatment of fistula; and his object having been to excite inflammation on a larger surface than the seton could possibly affect, and to keep up the inflammation, actively changing the point of irritation. He passed a long trochar at first downwards on the inside of the upper fragment, and made it pierce the skin behind and a little to the outside; the trochar was then withdrawn, and a silver wire passed through the canula, and out at the posterior opening. The canula was then withdrawn, and, being replaced on the trochar, they were introduced again above and on the outside of the lower fragment, and made to issue at the same opening behind, leaving a loop in front. I then made an incision, continues Sommé, in front from one orifice to the other, made by the trochar, drawing the extremities of the wire through the wound, brought the loop between the fractured ends

of the bone and the approximated edges of the skin, with sticking plaster. The limb was kept at rest in a box so contrived, that the wound could be dressed without disturbing the fragments. At each dressing, he drew down the wire so as to depress the loop more and more into the flesh; no bad symptoms presented; and union was distinct six weeks after the operation. The wire was withdrawn five or six days after union had become evident, but before it had quite divided the soft parts which it encircled. The wound cicatrised in about two weeks. Three months after the performance of the operation, the apparatus was removed, and the patient got well with a considerable callous tumour but no shortening. (*Med. Chirurg. Trans.* vol. xvi, p. 43.)

In a case of jointed tibia thirteen weeks after fracture, Seerig affected union by a process somewhat resembling that of Sommé. He employed a seton, or ligature as Troschel calls it, composed of twelve threads, which he looped about the connecting membrane between the fragments, and daily tightened by means of a serre noeud of Græfe. A longitudinal incision two inches long, was made on each of the two sides of the tibia, parallel to the ridge of that bone, while the fragments were as much as possible separated from each other; then with a needle, curved like the letter S, he conducted the ligature around the interarticular mass. The ligature came away the sixteenth day; at the end of a month the external wounds were cicatrised, and two weeks after the consolidation was complete. (*Arch. Gén.* for Jan. 1839, p. 105.) We are not aware that either of these ingenious operations has been performed more than once.

The method of Sommé is favourably mentioned by Sanson and by Vidal de Cassis. Oppenheim regards it with respect, but naturally prefers his own modification. We would be glad to see the latter, as well as the methods of Gulliver, of Rhynd, of Sommé, and that of Seerig, subjected to the test of further experiment. They appear to be as rational as any of the plans hitherto in vogue, in which the knife is used, and may prove to be much more applicable to the majority of cases. Certain it is that neither the seton as at present employed, nor any of the various radical operations, have the slightest claim to be regarded as specific in the treatment of supernumerary joint.

"The result," observes Oppenheim, "of all the methods hitherto applied for the cure of this lesion is so unfavourable, that several of the most astute surgeons are fearful of recommending any of them. Larrey maintains, that in those cases in which a cure has been effected, the artificial joint was not very chronic, there had been no loss of osseous matter, the fragments were in contact, and, lastly, the patient was young. If union does not take place after bandaging, the application of oily and aromatic frictions, and quiet and regimen, the case must be left to nature. The patient by degrees becomes habituated to his lameness, which is gradually lessened by time and use, and, finally, the limb being enveloped in pasteboard, is of almost unlimited service. He instances five cases supporting his views. Boyer, Richerand and Palletta are not more favourably inclined to the methods usually employed."

We are not prepared, after a careful review of the history of the treatment of supernumerary joints, to take so discouraging a view of its uncertainty; but we cannot help feeling, in the highest degree, impressed with the great importance of giving more and more attention to the indications in individual cases, by which means alone can be determined the precise value of the different modes of treatment in each form of pseudarthro .